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ELIHU ROOT,
HONORARY PRESIDENT

ALTON B. PARKER,
HONORARY VICE-PRESIDENT

S. STANWOOD MENKEN,
PRESIDENT

FRANKLIN REMINGTON,
SECRETARY

GEORGE WHARTON PEPPER,
PHILADELPHIA
WILLET M. SPOONER,
MILWAUKEE
LUKE E. WRIGHT,
MEMPHIS
JAMES W. GERARD,
NEW YORK
MYRON T. HERRICK,
OHIO
VICE-PRESIDENTS

NATIONAL SECURITY LEAGUE

19 WEST 44TH STREET
NEW YORK

New York, June 6, 1918

Dear Sir:

The conduct of the war and, in fact, the very future of America, are dependent, not only upon the election of a war Congress that will enact necessary laws, but upon the presence in the National Legislature of men of vision, ability and broad experience, who are the best qualified of our citizenship to correctly solve the great internal and international questions which will come before the next Congress.

The National Security League, pursuant to unanimous action of its Executive Committee, has taken upon itself the grave duty of impressing these matters upon you and asking you to pledge your service for prompt action to prevent disaster which might follow the election of incompetent or disloyal men to Congress. This can be prevented through definite and concerted action on the part of loyal citizens who are in the vast majority. Neglect and indifference may prove fatal.

The remedy is for everyone to assume the personal obligation of speaking with, or writing without delay to, political leaders, newspaper men and others who form public opinion in their Congressional Districts. Make them realize sharply that the need of the nation is the election of men of absolute and unconditional loyalty who are determined to prosecute the war to victory and who possess the strength of character and unquestioned ability to be of real service to the country in this crisis. The problems before the nation are such as to try the very souls of the best men that we can elect.

The people of your district will undoubtedly take the right stand if awakened to the political

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situation in time to secure the highest type of candidates to vote for in the primaries. Every citizen can directly influence results to that end, and we earnestly hope that you will recognize the responsibility of so doing.

This letter is being sent to prominent persons generally throughout the United States and has no relation to the merits or demerits of any particular Representative, nor is it a criticism of the present Congress which has done loyal and patriotic work. We will be very glad to learn from you your view of the situation, and whether you will enter upon the work with enthusiasm. We will take pleasure in forwarding to you additional copies of this letter for distribution if you desire the same.

Very truly yours,
NATIONAL SECURITY LEAGUE

Franklin Remington
Secretary

EXTRACT FROM MR. ROOT'S ADDRESS AT THE ANNUAL MEETING OF THE LEAGUE HELD WEDNESDAY, MAY 8th, 1918

We are going to elect a Congress this coming fall. There is one great single predominant qualification for an election to that Congress, and that is a loyal heart. (Applause).

I don't care whether a man is a Democrat or a Republican or a Progressive or a Socialist or a Prohibitionist, or whatnot, he must have a loyal heart, or it is treason to send him to Congress. (Applause). There are probably from twenty to thirty Congressional districts in this country where there is a loyal majority but where there is so large a disloyal minority that a division of the loyal majority may let a pro-German in. In every one of those districts, Democrats and Republicans and all loyal men should get together, and agree upon the loyal man of one party or the other who is the surest to carry the district, and all unite on him without regard to party. (Applause).

Any man who would not accept the idea and follow it, I would want to live a hundred years to vote and work against. (Applause). Human nature has not changed. There are going to be parties, going to be politics hereafter; but now they are subordinate, they are unimportant. The one thing only is to win the war, and put men in Congress who will represent the driving power of the American people; the driving power that is behind Congress, that is behind the Administration, and that, God grant, may make itself felt behind the men who are puttering over contracts and lingering on the road to victory. (Applause).

The great thing is to make Germany feel that the hundred millions of America are going, as one man, to beat them (applause), to make every American feel that all the rest of the hundred millions are with him in his mightiest efforts to beat the German. (Applause.)

184705

The American Red Cross
The Red Cross Institute for Crippled and Disabled Men
311 Fourth Avenue New York City

The Duty of the Employer in the Reconstruction of the Crippled Soldier

WE must count on the return from the front of thousands of crippled soldiers. We must plan to give them on their return the best possible chance for the future.

Dependence cannot be placed on monetary compensation in the form of a pension, for in the past the pension system has proved a distinct failure in so far as constructive ends are involved. The pension has never been enough to support in decency the average disabled soldier, but it has been just large enough to act as an incentive to idleness and semi-dependence on relatives or friends.

The only compensation of real value for physical disability is rehabilitation for self-support. Make a man again capable of earning his own living and the chief burden of his handicap drops away. Occupation is, further, the only means for making him happy and contented.

With the humanitarian aim of restoring crippled men to the greatest possible degree and the economic aim of sparing the community the burden of unproductivity on the part of thousands of its best citizens, the European countries began soon after the outbreak of hostilities the establishment of vocational training schools for the rehabilitation of disabled soldiers. The movement had its inception with Mayor Édouard Herriot of the city of Lyons, France, who found it difficult to reconcile the number of men who had lost an arm or legs, but were otherwise strong and well, sunning themselves in the public squares, with the desperate need for labor in the factories and munition works of the city, so he induced the municipal council to open an industrial school for war cripples, christened the École Joffre. This institution opened to receive its first pupils in December, 1914. It has proved the example and inspiration for hundreds of similar schools since founded throughout France, Italy, Germany, Great Britain and Canada.

The disability of some crippled soldiers is no bar to returning to their former trade, but the injuries of many disqualify them from pursuing again their past occupation. The schools of re-education prepare these men for some work in which their disability will not materially prejudice their production.

The education of the adult is made up largely of his working experience. The groundwork of training in his past occupation must under no circumstances be abandoned. The new trade must be related to the former one or be, perhaps, an extension or specialization of it. For example, a man who had done manual work in the building trades may by instruction in architectural drafting and the interpretation of plans be fitted for a foreman's job, in which the lack of an arm would not prove of serious handicap. A trainman who had lost a leg might wisely be prepared as a telegrapher, so that he could go back to railroad work, with the practice of which he is already familiar.

Whatever training is given must be thorough, for an adult cannot be sent out to employment on the same basis as a boy apprentice. He must be adequately prepared for the work he is to undertake.

One of the great modern advantages to the one-armed soldier are the working appliances which are supplanting the artificial limb designed largely for appearances. The new appliances are designed with a practical aim only in view; they vary according to the trade in which the individual is to engage. For example, the appliance for a farmer would be quite different from that with which a glassblower would be provided. Some appliances have attached to the stump a chuck in which various tools or hooks can interchangeably be held. The wearer uses these devices only while at work; for evenings and holidays he is provided with a "dress arm" which is made in imitation of the lost natural member.

An important factor in the success of re-educational work is an early start, so that the disabled man shall have no chance to go out unemployed into the community. In even a short period of exposure to the sentimental sympathy of family and friends, his "will to work" is so broken down that it becomes difficult again to restore him to a stand of independence and ambition. For this reason, therefore, the plan for his future is made at as early a date as physical condition admits, and training is actually under way before the patient is out of the hospital.

In the readjustment of the crippled soldier to civilian life, his placement in employment is a matter of the greatest moment. In this field the employer has a very definite responsibility.

But the employer's duty is not entirely obvious. It is, on the contrary, almost diametrically opposite to what one might superficially infer it to be. The duty is not to "take care of," from patriotic motives, a given number of disabled men, finding for them any odd jobs which are available, and putting the ex-soldiers in them without much regard to whether they can earn the wages paid or not.

Yet this method is all too common. A local committee of employers will deliberate about as follows: "Here are a dozen crippled soldiers for whom we must find jobs. Jones, you have a large factory; you should be able to take care of six of them. Brown, can you not find places for four of them in your warehouse? And Smith, you ought to place at least a couple in your store."

Such a procedure cannot have other than pernicious results. In the first years of war the spirit of patriotism runs high, but experience has shown that men placed on this basis alone find themselves out of a job after the war has been over several years, or in fact, after it has been in progress for a considerable period of time.

A second weakness in this method is that a man who is patronized by giving him a charity job, comes to expect as a right such semi-gratuitous support. Such a situation breaks down rather than builds up character, and makes the man progressively a weaker rather than a stronger member of the community. We must not do our returned men such injury.

The third difficulty is that such a system does not take into account the man's future. Casual placement means employment either in a make-shift job as watchman or elevator operator such as we should certainly not offer our disabled men except as a last resort—or in a job beyond the man, one in which, on the cold-blooded considerations of product and wages, he cannot hold his own. Jobs of the first type have for the worker a future of monotony and discouragement. Jobs of the second type are frequently disastrous, for in them a man, instead of becoming steadily more competent and building up confidence in himself, stands still as regards improvement and loses confidence every day. When he is dropped or goes to some other employment, the job will have had for him no permanent benefit.

Twelve men sent to twelve jobs may all be seriously misplaced, while the same twelve placed with thought and wisdom and differently assigned to the same twelve jobs may be ideally located. If normal workers require expert and careful placement, crippled candidates for employment require it even more.

The positive aspect of the employer's duty is to find for the disabled man a constructive job which he can hold on the basis of competence alone. In such a job he can be self-respecting, be happy, and look forward to a future. This is the definite patriotic duty. It is not so easy of execution as telling a superintendent to take care of four men, but there is infinitely more satisfaction to the employer in the results, and infinitely greater advantage to the employee. And it is entirely practical, even in dealing with seriously disabled men.

A cripple is only debarred by his disability from performing certain operations. In the operations which he can perform, the disabled man will be just as efficient as his non-handicapped colleague, or more so. In the multiplicity of modern industrial processes it is entirely possible to find jobs not requiring the operations from which any given type of cripples are debarred. For such jobs as they can fill the cripple should be given preference.

Thousands of cripples are now holding important jobs in the industrial world. But they are men of exceptional character and initiative and have, in general, made their way in spite of employers rather than because of them. Too many employers are ready to give the cripple alms, but not willing to expend the thought necessary to place him in a suitable job. This attitude has helped to make many cripples dependent. With our new responsibilities to the men disabled in fighting for us, the point of view must certainly be changed. What some cripples have done, other cripples can do—if only given an even chance.

The industrial cripple should be considered as well as the military cripple, for in these days of national demand for the greatest possible output there should not be left idle any men who can be made into productive workers.

With thoughtful placement effort, many men can be employed directly on the basis of their past experience. With the disabled soldiers who profit by the training facilities the government will provide, the task should be even easier.

This, then, constitutes the charge of patriotic duty upon the employer:

To study the jobs under his jurisdiction to determine what ones might be satisfactorily held by cripples. To give the cripples preference for these jobs. To consider thoughtfully the applications of disabled men for employment, bearing in mind the importance of utilizing to as great an extent as possible labor which would otherwise be unproductive. To do the returned soldier the honor of offering him real employment, rather than proffering him the ignominy of a charity job.

DOUGLAS C. MCMURTRIE, *Director*

PRESIDENTS ELECTED FROM NEW YORK

"When Cleveland Was Governor"

BY

WILLIAM GORHAM RICE

State Civil Service Commissioner

[Subject headings for cataloging this pamphlet:
"Presidents Elected from New York," "New York State and the Presidency,"
"Presidential Election of 1884," "Grover Cleveland"]

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WHEN CLEVELAND WAS GOVERNOR

Story of the exciting days in Albany in 1884, after the State's chief executive had been nominated for president by the Democratic convention at Chicago

By WILLIAM GORHAM RICE

State Civil Service Commissioner

William Gorham Rice, author of this article, was a secretary to Governor Grover Cleveland. He was intimately cognizant of the events going on in the executive chamber at that time and is in a position to relate many interesting incidents preceding the presidential election of 1884, when Mr. Cleveland was first elected president of the United States. The controlling influence of New York State in national politics was well illustrated in the ascendancy to public life of Grover Cleveland, who rapidly rose from being sheriff of Erie county to mayor of Buffalo and governor of New York. This brought him into national prominence in a few years. Colonel Rice gives some election figures which will not fail to attract attention in this and other states during this gubernatorial year, when candidates for the presidency are certain to be brought into the limelight.— EDITOR.

William Gorham Rice

NATIONAL party conventions, both Democratic and Republican have always specially considered the merit and fitness of New York men for the presidential nomination. Gubernatorial experience in New York — a true service record — has almost inevitably given its possessors a preferred rating and often has put such governors at the head of the list. As a result, the assembled delegates on ten different occasions have selected one who was then, or previously had been, governor of New York as the best qualified leader of his party. Five times the governor thus chosen has won in a presidential election following. Interest in several of these elections in which New York governors were national candidates rose to a fierce intensity after the polls closed, for the result of the campaign continued in doubt for many hours. What the outcome would be was uncertain once until almost the very hour of the presidential inauguration.

This last was the prolonged Tilden-Hayes contest in 1876, which began while Tilden was governor in the old capitol. Eight years later came the stirring Cleveland-Blaine contest, with Cleveland as governor, the executive chamber being then, as now, in the present capitol. The Roosevelt-Parker contest of 1904, the Wilson-Roosevelt-Taft contest of 1912, and the Wilson-Hughes contest of 1916, each again brought the record of a New York governor under scrutiny, for Roosevelt and Hughes both had shown distinguished administrative ability in their occupancy of the office of governor. And looking into the near future, one does not need to be practiced in presidential horoscopy to perceive the stars of 1920 giving prediction that the present chief executive of New York will bear a commanding part as the lines of the next presidential campaign are formed.

Two other governors besides those already mentioned are also to be recalled as associated with the presidency. These are Martin Van Buren and Horatio Seymour. Governor Van Buren, twice nominated for president as the candidate of his unified party, was successful in 1836, but lost the election in 1840. Again nominated in 1848, but this time as the courageous protest candidate of the " free soil " third party, again he was defeated. Governor Seymour, though in the years from 1853 to 1865 four times a candidate for the governorship, and twice elected to that office, nevertheless was defeated for the presidency in 1868, losing to General Grant.

No New York State man has ever been elected president of the United States unless he has previously served as governor. It would seem also that, without exception such successful candidates from this State have shown in the office of governor characteristics which appealed definitely to independent political sentiment outside of party lines. By these characteristics they drew to themselves the large unattached vote which always has existed in the Empire State, a vote which has been a deciding factor in not a few elections, both in the State and in the nation at large. Study of the vote for presidential electors indicates clearly that Van Buren, Tilden, Cleveland, and Roosevelt all gained the support of this unattached or independent element.

My story here is to concern itself particularly with 1884, when Mr. Cleveland was governor. Elsewhere, and particularly in the *Century Magazine* for June, 1912, and in the *North American Review* for January, 1914, I have spoken of these events more in detail, and have recorded additional facts which may have at least some minor historical value.

I went to the Democratic convention at Chicago in 1884, prepared to answer questions about the record of Governor Cleveland, because as a secretary in the executive chamber, I knew what he had done in legislation, what appointments he had made, and what opinions he had expressed. While he was one whose rugged integrity showed more and more in office, one whose record has come increasingly to give him a place in our history as a great American, his early political advance was due to the far-seeing discrimination and untiring effort of a small group of men who thoroughly believed in him. The words, "Public office is a public trust," defined his character to them even before he had become governor. Nor did he fail as a high office holder to exemplify that sentiment as a rule both of faith and practice. In these words he affirmed a measure of duty and set a standard which definitely elevated political life throughout the United States.

That Cleveland's was an ever-increasing hold upon public sentiment would seem to be indicated by his constant popular majority. However, notwithstanding his increased popular majority, he failed to receive in 1888 a majority of the electoral vote, for Harrison then gained the presidency. In 1884 Mr. Cleveland's popular majority was 62,683; in 1888 it was 98,017; in 1892 it was 380,810. In passing it may be noted that Tilden, though not seated in the presidential chair, had a popular majority of 250,935 over Hayes in 1876; that Roosevelt had 2,545,515 over Parker in 1904, and that Wilson's popular majority over Hughes in the last election was 591,385.

Analysis seems to prove that Mr. Cleveland's ever-increasing vote came chiefly from independent sources, for substantially always and everywhere his vote was greater than that of his party associates who were candidates in the same election. Tilden, Roosevelt, and Wilson appear likewise to have led their tickets.

Neither his nomination for the presidency in 1884 nor the canvass affected Governor Cleveland. It was, in fact, a source of continued surprise to us in the executive chamber to see how, during the summer and autumn of 1884, he fulfilled with his usual care and patience his daily duties at Albany. He determined pardon applications; he investigated public health complaints; he considered personally the many prosaic matters that make up the routine work of a governor.

Several times during that summer he went fishing for a day. There comes clearly to my mind one morning when the governor and Daniel Manning, then president of the National Commercial Bank and proprietor of the Albany *Argus*, started off for such a trip. Looking from the executive chamber into the street below, I saw the fishermen as they came from the capitol and walked together down State street. Cleveland, by the way, always used the private entrance and staircase to the executive chamber, then conveniently existing. The future president and his future secretary of the treasury both wore large Panama hats; their shoulders were broad and they had much the same ample generosity of waist measure. There was indeed a pervasive atmosphere of rotund jollity about them both, which it is a pleasure to remember. With the cares of state and cares of business laid aside, they were off for a day of enjoyment. Nor were they afraid to show it. Just where they went that morning, I do not know. Possibly it was for a forenoon to be spent with Seth Green on the island below the city, with a planked shad dinner at noon, or possibly for a whole day of fishing on Lake George.

Grover Cleveland in 1884 when he was governor and a candidate for president

Later the governor took his usual vacation in the Adirondacks. Saranac lake was then his destination, and his friend, Dr. Samuel B. Ward, of Albany, was his companion. Paul Smith, too, of North Woods' fame, often found his way to the good-fellowship of the camp, which was not far from the Smith domain.

All through the 1884 campaign Governor Cleveland spent his time chiefly in the large room of the executive chamber. He met there and advised with those who called upon him from all parts of the country; he sought no one; he saw freely everybody who came. In the political excitement about him, he was always calm and well settled as to his course. His candidacy made little change in his accustomed life. His speech of acceptance was delivered on a bright July day, at the executive mansion, to the national committee of notification and a score of other guests. Among these guests was the very charming girl, Miss Frances Folsom, of Buffalo, who two years later became the mistress of the White House. Mr. Cleveland's acceptance speech, his later letter of acceptance, and two brief addresses, one in New Jersey and one in Connecticut, constituted virtually all his extended formal public utterances during the presidential campaign. In fact, he went out of the State only twice, and then but for the few hours required to make the Newark and Bridgeport speeches above referred to. Mr. Cleveland, painstaking, deliberate, unversed in political manoeuvers, and comparatively unknown, in many respects besides that of speechmaking, was the antithesis of the brilliant secretary of state, the experienced campaigner, the shrewd party manager, and intimate of great business interests, Mr. Blaine, the candidate of the opposing party.

After a campaign perhaps unequalled in party heat from beginning to end, interest suddenly intensified, flamed up after the polls had closed, and centered upon the vital question whether Blaine or Cleveland had carried New York State. To which side would the balance go? If in the one direction, Democracy, after its long exclusion from power, would be triumphant in the nation; if in the other, Republicanism would remain dominant. At once remembrances of the prolonged 1876 controversy became vivid. Again the country was confronted with the danger of a disputed title to the presidency. Again the possibility even of civil war came to men's minds.

Mr. Cleveland, after voting in Buffalo early on election day, returned to Albany. For the evening he invited a very few intimate friends to receive the returns with him at the executive mansion. The governor's house, while in the same location on Eagle street as now, was at that time a much smaller affair, the main drawing-room on the north having been added, and many other enlargements made during Governor Hill's seven years' administration. Among the friends there November 4th, at the beginning of the evening were: Governor Cleveland's sister, Mrs. Hoyt, the adjutant-general and Mrs. Farnsworth and Miss Farnsworth, Mrs. Isaac Vanderpool, Justice Rufus H. Peckham, Charles B. Andrews, Edgar K. Apgar, and Colonel and Mrs. Lamont. Later, Eugene T. Chamberlain, Charles Tracey, John Boyd Thacher, A. Bleecker Banks, and Dr. Samuel B. Ward came in. Mrs. George Evans and Mr. Lawrence Turnure were there also for a brief time. Mrs. Hoyt or another sister, Miss Rose Elizabeth Cleveland, was always with Mr. Cleveland at the executive mansion during the time he was governor.

Daniel Manning, secretary of the treasury under President Cleveland

Soon after the polls closed congratulatory telegrams began to pour in at the executive mansion. Many of these dispatches and friendly newspaper bulletins asserted that New York State had gone for Mr. Cleveland by many thousands. But very few detailed figures were received. There was no telegraph wire at the executive mansion that night, and the telephone had gone out of commission in a rain storm, which, as the hours progressed, became almost a deluge. Messengers were the only means of contact with the outside world.

In this situation I decided to go to the Albany *Argus* newspaper office, hoping to get definite figures upon which to form a judgment. Arrived at that office, I began before long to obtain from the working press wire fairly exact, though fragmentary returns. Assembling these partial totals, I soon found myself at variance with the general opinion that New York State had given Mr. Cleveland a large majority. My conclusion was based upon a maintained percentage of majority shown by the continued building up of exact figures from more and more election districts, both in cities and in rural communities throughout the State. This method of figuring to early determine the trend of election returns is now well known, but in those days it was not so often used. Nevertheless it was one which I had worked out in previous elections with marked success, and one with which Colonel Lamont was conversant.

The detailed figures showed the drift constantly favorable to Mr. Cleveland. Yet the percentage of majority was so slight that it indicated that he had carried the State by only about 2,000. This rather startling deduction I wrote out, with totaled district figures sustaining it, and sent it about eleven o'clock, by special messenger, to Colonel Lamont, who was still with Mr. Cleveland at the executive mansion. The situation immediately became a subject of careful consideration there by four or five men who had been in particularly close touch with the contest in New York State.

Soon after midnight, Apgar, Tracey, Lamont and one or two others and I met and began to send duplicates of a form telegram to two or more prominent party associates in virtually every county of the State, urging them to call to their assistance at once vigorous and courageous friends, and to see that every vote cast was honestly counted. We signed this telegram with the name of Daniel Manning, chairman of the Democratic State committee, though he was not present.

With more time at my disposal, I should probably be able to refresh my memory from various sources and record more of the names of those to whom this telegram went. At present I think of the following: Daniel Magone, in St. Lawrence county; O. U. Kellogg, Cortland; Francis Lynde Stetson, New York; Alfred C. Chapin, Kings; William Church Osborn, Putnam; Smith M. Weed, Clinton; G. H. P. Gould, Lewis; Jeremiah W. Finch Warren; Robert Hamilton, Washington; W. S. Waterbury, Saratoga; Daniel G. Griffin, Jefferson; Wilson S. Bissell Erie; James Shanahan Montgomery; Samuel A. Beardsley, Oneida; Robert A. Maxwell, Genesee; William A. Beach — " Billy " Beach, Onondaga; Ward Gregory, Tompkins; Samuel J. Tilden, Jr., Columbia; Henry A. Reeves Suffolk; Alton B. Parker, Ulster; Samuel T. Benedict, Schenectady; and David B. Hill, Chemung. D-Cady Herrick fulfilled this request in Albany county.

Later, early in the forenoon of Wednesday, telegrams to other representative citizens of the highest standing asked them to go to the clerk's office in their respective counties, to remain there until the returns were filed, and then to obtain certified copies of such returns and send these copies without delay by special messenger to Albany. Thus gradually semi-official returns were assembled at the executive chamber and Mr. Cleveland's majority was more accurately known there than anywhere else. The exact majority determined finally by the State canvassing board in the following December was 1,047.

When the executive chamber tabulation of detailed returns covered the whole State, and Mr Cleveland was satisfied that the totals told the truth, he sent to Edward Murphy, of Troy, this telegram:

> I believe I have been elected president, and nothing but the grossest fraud can keep me out of it, and that we will not permit.

This declaration was bulletined throughout the country.

But it was not until about 10 o'clock in the morning of Friday, November 7th, the third day after the election, when the manager of the Western Union Telegraph Company, Mr. F. W. Sabold, came himself to the executive chamber and delivered into Mr. Cleveland's own hand a message received over a cleared special wire, that the situation was relieved of doubt. I remember well the arrival of Sabold and his saying that he had a message of the utmost importance which he could give to Mr. Cleveland only. This was the message that he brought:

> GOVERNOR CLEVELAND:
>
> I heartily congratulate you on your election. All concede that your administration as governor has been wise and conservative, and in the larger field as president I feel that you will do still better, and that the vast business interests of the country will be entirely safe in your hands.
>
> JAY GOULD.

Coming from one of the most conspicuous of his opponent's supporters from one whose control of the Western Union Telegraph Company gave him unusual opportunities for information, from one who had continued until then to claim Mr. Blaine's election it satisfied Mr. Cleveland that the contest was over and the victory won.

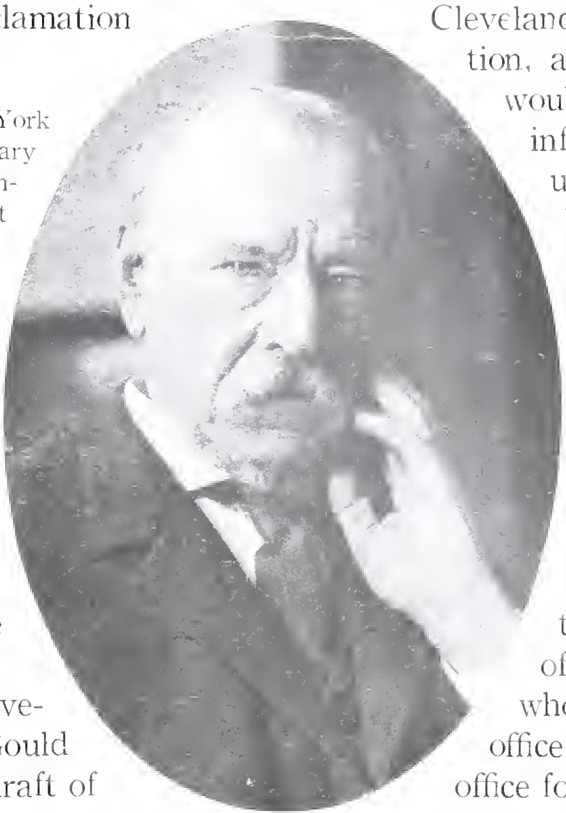
After reading this telegram, Mr. Cleveland handed it to me, and said: "Well, Rice, I guess it is time to write our Thanksgiving Day proclamation. Where is your little book?" The little book was "Synonyms and Antonyms," by Bishop Fallows. Mr. Cleveland had some time before discovered this upon my desk, and he made use of it many times. Thereupon, at his desk, the same large one that now occupies the center of the executive chamber, he wrote with his own hand, dating it the next day, when it was to be issued, the proclamation beginning:

> The people of the State of New York should permit neither their ordinary occupations and cares, nor any unusual cause of excitement, to divert their minds from a sober and humble acknowledgment of their dependence upon Almighty God for all that contributes to their happiness and contentment, and for all that secures greatness and prosperity to our proud commonwealth. . . .

This I have always considered his first writing after he felt assured of the presidency.

Subsequently Mr. Cleveland gave me the Jay Gould telegram and the original draft of the Thanksgiving proclamation, as mementoes of those eventful days when he was governor.

This chapter of my story cannot be concluded better than with some words concerning the count in New York State, spoken to me late in October, 1912, at Princeton, by Mrs. Cleveland: "You and I know," she said, "the presidency would have possessed no interest for Mr. Cleveland had he felt there was the remotest taint upon his title."



Last photograph of Mr. Cleveland, taken in 1908

When Mr. Cleveland began to consider his cabinet and other important matters, letters came to him in great numbers. Some letters were serious; some were amusing. Some asked office; some gave advice. Some were congratulatory, some denunciatory. They ran through that whole gamut of sentiment which correspondents, known and unknown, pour out upon every occupant of high public office, and particularly upon a president-elect. One group of these was most curious. The writer of them was a newspaper man of high reputation and of wide acquaintance with Washington life. He called on Mr. Cleveland at Albany soon after election, and when he left, stated he would send from time to time information about public men, unsigned, but in his own handwriting. Thereupon there began to come a daily envelope containing unsigned cards of convenient form for filing. These cards treated of nearly everybody proposed for the cabinet, of distinguished visitors announced in the public press as on their way to Albany, and of well-known men generally who might be commended for office themselves or might ask office for others. There was a separate card for every person, and his good points were written in red ink while discreditable facts and undesirable characteristics appeared in black. Thus each card embodied a concise record of the deeds and a keen estimate of the character and influence of the man named therein. Giving as they did an incisive, impartial, and I believe, upon the whole an accurate analysis of those about whom they were written, they presented a comment of unusual wit and wisdom upon American national politics. The point of view was that of an experienced and able observer of current events, and the whole record made a kind of judgment day book of men of both parties conspicuous in national affairs; in civil life and in the army and navy.

It can readily be imagined that not a few visitors who came to see Mr. Cleveland were surprised at the knowledge of the political affiliations of prominent men shown by the the supposed unsophisticated president-elect.

Mr. Cleveland continued as governor until the next meeting of the legislature, when, again at the large central desk in the executive chamber, and again with his own hand, he wrote out this shortest message on record:

To the Legislature: *January* 6, 1885.

I hereby resign the office of governor of the State of New York. GROVER CLEVELAND.

Here was no pointing with pride; no glorification of self nor laudation of party; only the laying down by a man of simplicity and truth of one place of public service to take up at the call of his country another and more arduous task. His quality was recognized when Lowell gave to him the words of Palinurus, the pilot of Æneas: "Jove, you may save me if you will, you may sink me if you will, but come what may, I will keep my rudder true."

NOTES

Millard Fillmore of New York became president through the death of Zachary Taylor. Chester A. Arthur of New York became president through the death of James A. Garfield. Theodore Roosevelt of New York became president, first, through the death of William McKinley, and subsequently became president by election November 8, 1904.

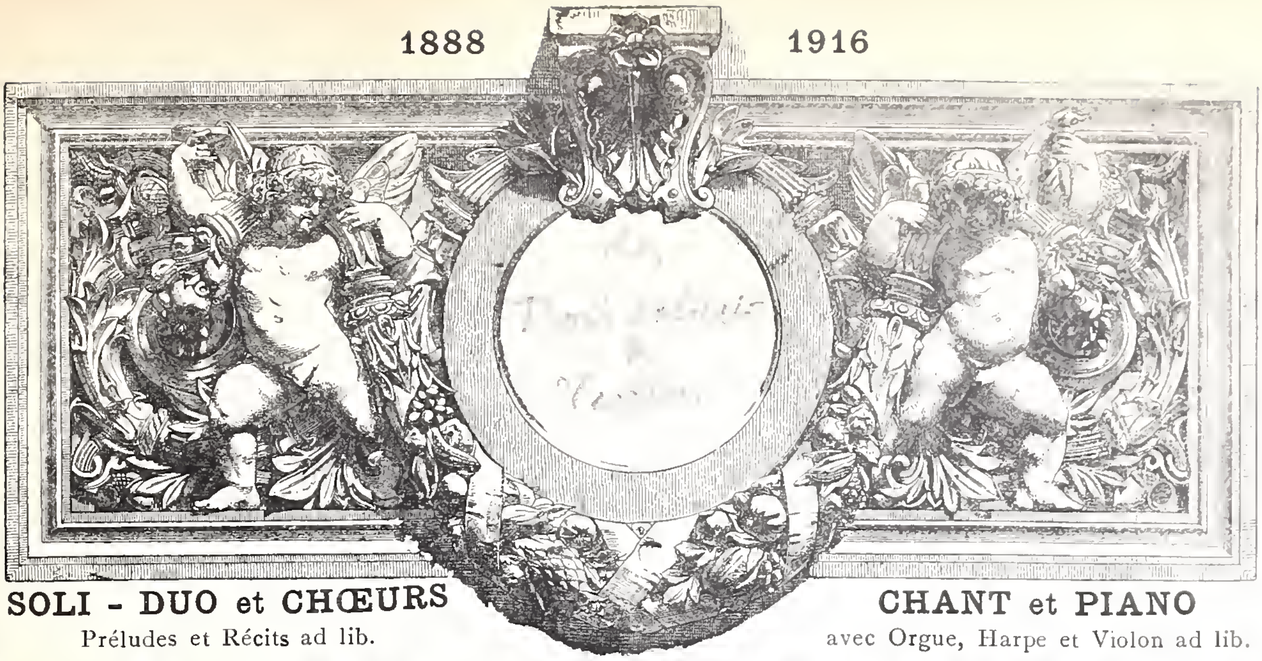
* * *

In the April number of STATE SERVICE, William Gorham Rice, who was a secretary to Governor Grover Cleveland, has written an excellent and interesting article in which he calls attention to the fact that national party conventions, Democratic and Republican, have always specially considered the merit and fitness of New York men for the presidential nomination. He calls attention to the fact that on ten different occasions one who was then, or previously had been, governor of New York State was nominated for the presidency, and that five times the governor thus chosen had won the presidential election. * * * The fact referred to by Mr. Rice is worthy of consideration, namely: the necessity existing for a successful candidate to call to himself the vote of independent political sentiment outside party lines. In late years Cleveland, Roosevelt and Wilson are examples of candidates for public office who have gained the support of the independent vote. [Albany *Knickerbocker Press* Editorial, April 11, 1918.]

* * *

In STATE SERVICE Mr. William Gorham Rice, who had experience in secretarial service in the Executive office at Albany from 1883 to 1889, writes of New York nominees for president. * * * Ten times a governor or former governor of New York has been nominated for president, five times elected president. "No New York State man," Mr. Rice tells us, "has ever been elected president of the United States unless he has previously served as governor. It would seem, also, that, without exception, such successful candidates have shown in the office of governor characteristics which appealed definitely to independent political sentiment outside of party lines." [New York *Times* Editorial, April 17, 1918.]

1888 1916



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(IVth Part, 3sh Tale of the War)

Integral Adaptation by
S. CUTHBERT POIRSON
(1918)

Émile Abel CHIZAT
Paroles et Musique
(1917)

I

Three (Tommies (Sammies I saw at Verdun
Fast to the battle-field returning ;
Double quick pace and wih fierce eyes
Covered with blood, with blood, and with grape shot.

Chitd like them be without fear!
When come perillous stormy days
Forth to duty go with all thy courage
Have their stout big heart
And remember!

II

Two (Tommies (Sammies I saw at Verdun
Who were coming back from the battle-field,
Triumphant marching at full pace,
The other fell—he fell—under grape shot.

Child like them be wihtout fear!
When come perillous stormy days
Forth to duty go with all thy courage
Have their stout big heart
And remember!

III

At Verdun I saw his fresh grave
He sleeps in peace under the battle-field
So very gloriously wrapped up
In the noble sacred fotd of the flag!

Child tike them be without fear!
When come perillous stormy days
Forth to duty go with all lhy courage
Have their stout big heart
And remember!

IV

A day will come when at Verdun
A tofty tower will be erected
When all men shall sing and extol
The soldiers that rescued, rescued the World!

Child tike them be without fear!
When come perillous stormy days
Forth to duty go with all thy courage
Have their stout big heart
And remember!

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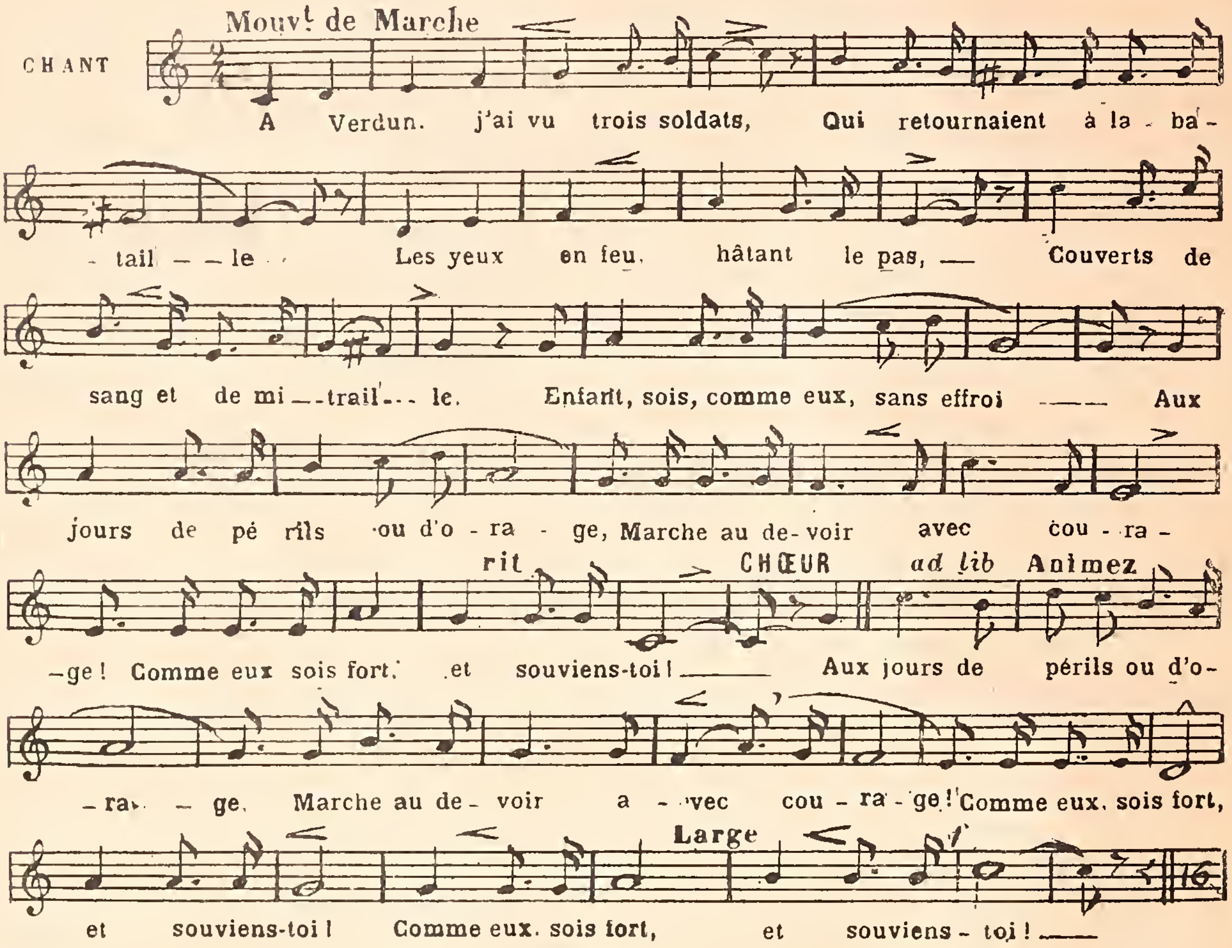
IVe Partie — 3e Conte de guerre
(1915-1918)
La 4e strophe, par **Maurice Dancourt**

Émile Abel CHIZAT
Paroles et Musique
1918


Mouvt de Marche
CHANT
A Verdun, j'ai vu trois soldats, Qui retournaient à la - ba-
- tail - - le
Les yeux en feu, hâtant le pas, — Couverts de
sang et de mi - - trail - - le. Enfant, sois, comme eux, sans effroi — Aux
jours de pé rils ou d'o - ra - ge, Marche au de-voir avec cou - ra -
-ge! Comme eux sois fort, et souviens-toi! —
rit
CHŒUR
ad lib
Animez
Aux jours de périls ou d'o-
- ra - ge, Marche au de - voir a - vec cou - ra - ge! Comme eux, sois fort,
et souviens-toi! Comme eux, sois fort, et souviens - toi! —
Large
16

La Bataille I

A Verdun, j'ai vu trois soldats,
Qui retournaient à la bataille,
Les yeux en feu, hâtant le pas,
Couverts de sang et de mitraille.

Enfant, sois, comme eux, sans effroi :
Aux jours de périls ou d'orage,
Marche au devoir avec courage,
Comme eux sois fort, et souviens-toi!

II *Le Retour*

A Verdun, j'ai vu deux soldats
Qui revenaient de la bataille,
Vainqueurs, marchant du même pas :
L'autre est resté sous la mitraille...

Enfant, sois, comme eux, sans effroi :
Aux jours de périls ou d'orage,
Marche au devoir avec courage,
Comme eux sois fort, et souviens-toi!

Le Repos III

A Verdun, j'ai vu son tombeau :
Il dort, sous le champ de bataille,
Dans les plis sacrés du Drapeau,
A la mesure de sa taille!

Enfant, sois, comme eux, sans effroi :
Aux jours de périls ou d'orage,
Marche au devoir avec courage,
Comme eux sois fort, et souviens-toi!

IV *La Tour de Verdun*

Un jour, à Verdun, l'on verra
S'élever une Tour immense,
Où le Monde entier chantera
Les Soldats de la Délivrance!

Enfant, sois, comme eux, sans effroi :
Aux jours de périls ou d'orage,
Marche au devoir avec courage,
Comme eux sois fort, et souviens-toi!

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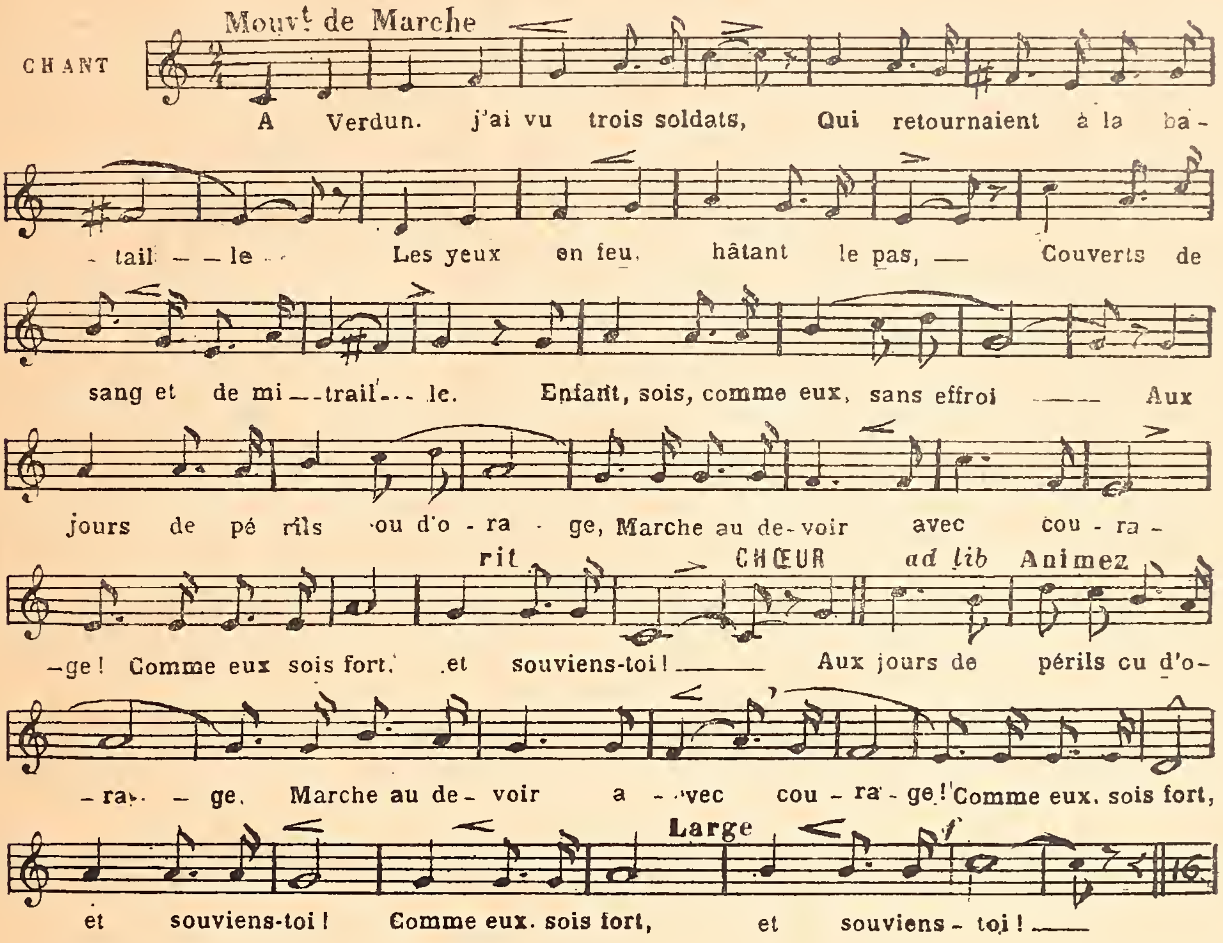
Mouvt de Marche
CHANT
A Verdun. j'ai vu trois soldats, Qui retournaient à la ba-
-tail--le-- Les yeux en feu. hâtant le pas, — Couverts de
sang et de mi--trail--le. Enfant, sois, comme eux, sans effroi — Aux
jours de pé rils ou d'o-ra-ge, Marche au de-voir avec cou-ra-
rit CHŒUR ad lib Animez
-ge! Comme eux sois fort. et souviens-toi! — Aux jours de périls ou d'o-
-ra--ge. Marche au de-voir a--vec cou-ra-ge! Comme eux. sois fort,
Large
et souviens-toi! Comme eux. sois fort, et souviens-toi! —
16

La Bataille — I

A Verdun, j'ai vu trois soldats,
Qui retournaient à la bataille,
Les yeux en feu, hâtant le pas,
Couverts de sang et de mitraille.

Enfant, sois, comme eux, sans effroi :
Aux jours de périls ou d'orage,
Marche au devoir avec courage,
Comme eux sois fort, et souviens-toi!

II — *Le Retour*

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Il dort, sous le champ de bataille,
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A la mesure de sa taille!

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Comme eux sois fort, et souviens-toi!

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S'élever une Tour immense,
Où le Monde entier chantera
Les Soldats de la Délivrance!

Enfant, sois, comme eux, sans effroi :
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Marche au devoir avec courage,
Comme eux sois fort, et souviens-toi!

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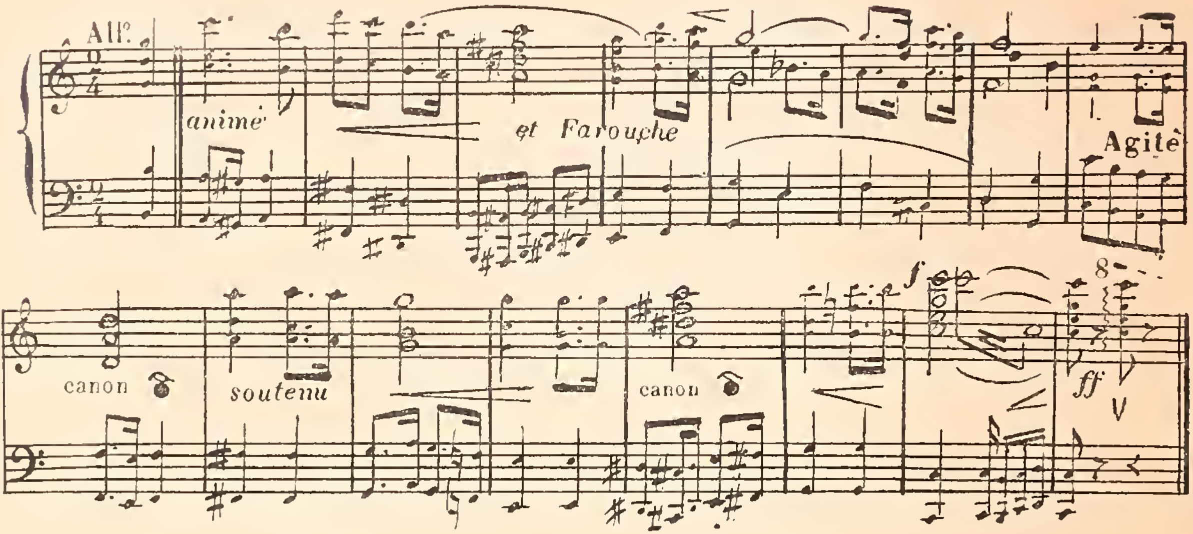
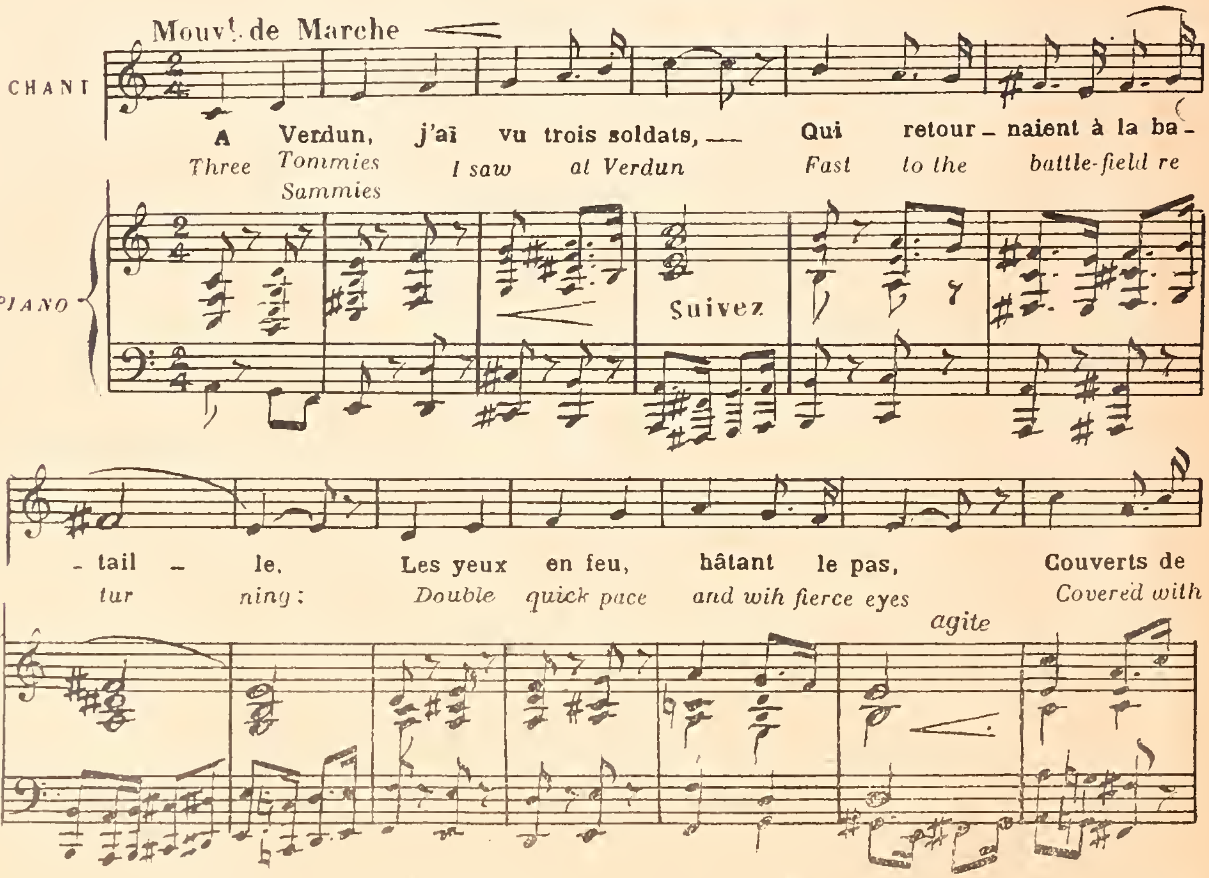
INTRODUCTION *(ad lib.)*



CONTE DE GUERRE


Mouvt. de Marche
CHANT
A Verdun, j'ai vu trois soldats, — Qui retour - naient à la ba -
Three Tommies Sammies I saw at Verdun Fast to the battle-field re
PIANO
Suivez
- tail - le. Les yeux en feu, hâtant le pas, Couverts de
tur ning: Double quick pace and wih fierce eyes Covered with
agite

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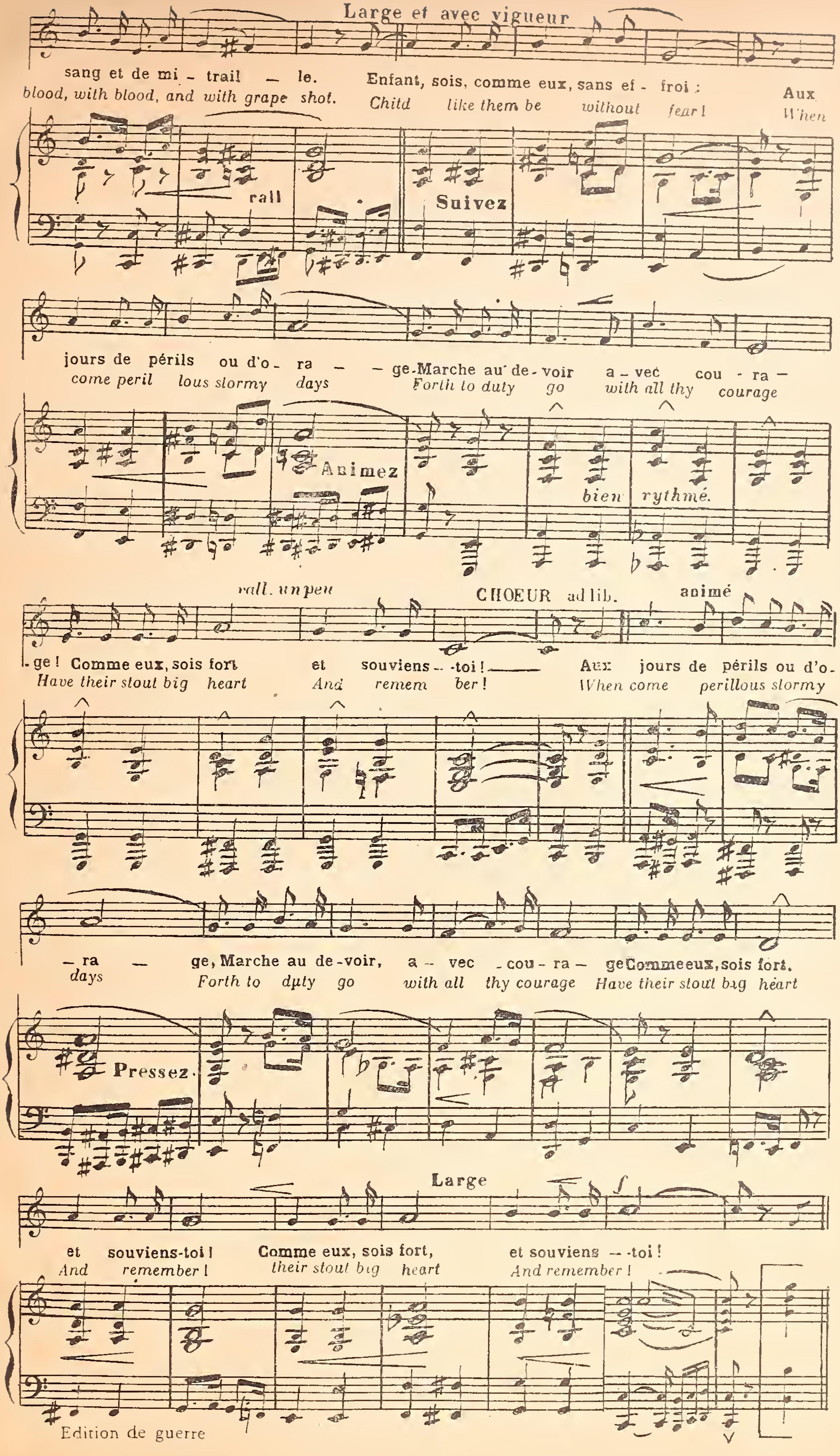
Large et avec vigueur
sang et de mi - trail - le. Enfant, sois, comme eux, sans ef - froi : Aux
blood, with blood, and with grape shot. Chitd like them be without fear! When
rall
Suivez
jours de périls ou d'o - ra - - ge. Marche au de - voir a - vec cou - ra -
come perilous stormy days Forth to duty go with all thy courage
Animez
bien rythmé.
rall. un peu
CHOEUR ad lib.
animé
- ge! Comme eux, sois fort et souviens - - toi! Aux jours de périls ou d'o-
Have their stout big heart And remem ber! When come perillous stormy
- ra - ge, Marche au de - voir, a - vec - cou - ra - ge Commeeux, sois fort.
days Forth to duty go with all thy courage Have their stout big heart
Pressez
Large
et souviens-toi! Comme eux, sois fort, et souviens - - toi!
And remember! their stout big heart And remember!

Edition de guerre

NOTA. — On peut revenir aux strophes suivantes sans répéter l'Introduction.

LES TROIS SOLDATS DE VERDUN

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And remember !

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Red Cross Institute for Crippled and Disabled Men
311 Fourth Avenue New York City

An American Program for the Rehabilitation of Disabled Soldiers

In order to fix on a program for the re-education of crippled soldiers of the American forces which should be mutually agreeable to all interested government departments and private agencies, the Secretary of War instructed the Surgeon-General of the Army to call a conference to discuss the matter and recommend a bill for presentation to Congress. This conference was held in Washington on January 14, 1918, invitations to attend having been sent to representatives of the various agencies concerned.

The attendance at this conference represented the following: Surgeon-General of the Army, Surgeon-General of the Navy, Surgeon-General of the Public Health and Marine Hospital Service, Bureau of War Risk Insurance, Bureau of Education, Federal Board of Vocational Education, Department of Labor, Federal Compensation Commission, Council of National Defense, Department of Civilian Relief of the American Red Cross, Red Cross Institute for Crippled and Disabled Men, American Federation of Labor, Chamber of Commerce of the United States, National Association of Manufacturers.

The Surgeon-General of the Army presented a program which had been worked out by his office providing for a comprehensive system of reconstruction, medical and economic, to be carried out under military auspices. The other conferees urged that, while medical and surgical repair was granted to be within the scope of the Surgeon-General's work, vocational training was a civilian matter and should be provided under civilian auspices. It was further argued that the after-care of the disabled soldier was already entrusted by Congress in some degree to the Bureau of War Risk Insurance, and that several other governmental departments had in the matter very definite interests and responsibilities.

After considerable discussion the matter was referred to a committee which was instructed to draw up definite recommendations regarding the program to be adopted. This committee met on several succeeding days, the conference proper being adjourned to meet again January 21 and receive the report of the committee.

On this latter date the committee brought in the draft of a bill for submission to Congress, calling for the creation of an inter-departmental commission to be known as the *Board of Vocational Rehabilitation.* After discussion, several amendments in modification of details were proposed and adopted. With these changes the bill was again referred to the committee to be put in final form and presented to the Surgeon-General of the Army for transmission to the Secretary of War as the measure proposed by the conference. It was so transmitted and is now being introduced in Congress.

The text of the measure as adopted by the conference is as follows:

A Bill to provide for the vocational rehabilitation and return to civil employment of persons discharged from the military or naval service of the United States disabled in the line of duty, and appropriating money for the expense thereof, and for other purposes.

Be it enacted, etc.

Section 1. That this act shall be known and cited as "The Vocational Rehabilitation Law."

Section 2. That every person, whether male or female, commissioned, enlisted, enrolled, or drafted into active service into the military or naval forces of the United States, disabled in line of duty while in such service, where the result is dismemberment or injury to sight or hearing or other disability (including disease), when discharged from, disenrolled from, or mustered out of the military or naval service, shall, upon the order of the Bureau of War Risk Insurance follow such course or courses of vocational rehabilitation as the Board for Vocational Rehabilitation, provided for in Section 3 of this act, shall prescribe and provide: Provided, however, that the provisions of this section shall not apply to any disabled person who in the opinion of said Bureau is able to resume his former occupation or to enter upon some other suitable gainful occupation without a course of vocational rehabilitation, nor to any disabled person not a claimant to the benefits provided by the Act of Congress approved October 6, 1917, entitled, "An Act to Amend an Act Entitled, 'An Act to Authorize the Establishment of a Bureau of War Risk Insurance in the Treasury Department' approved September 2, 1914, and for other purposes."

Section 3. That the said Bureau of War Risk Insurance is hereby empowered, in its discretion, to order any disabled person receiving benefits under the Act of Congress aforesaid, who is unable to pursue his former occupation or some other suitable gainful occupation, to follow a course or courses of vocational rehabilitation as herein provided; and every disabled person ordered by said Bureau to follow such course or courses shall, while pursuing the same, be entitled to, and the Bureau of War Risk Insurance shall pay, monthly compensation as for total disability in accordance with the provisions of Section 302 of the Act of Congress aforesaid, from which amount there shall be paid a family allowance for the benefit of his wife, children, or dependent widowed mother equal to the compensation for such persons as provided in Section 301 of said Act: Provided, however, that in case such disabled person while pursuing the course prescribed is engaged in some occupation which would reduce the amount of compensation under Section 302 of said Act, the compensation of such person together with the family allowance herein provided may, in the discretion of the said Bureau, be reduced to the extent of the amount earned in such occupation.

The compensation herein provided shall be in lieu of all other compensation for the period of the course or courses prescribed; Provided, that in case any person ordered to follow a course or courses as herein provided fails to pursue the same in a manner satisfactory to the Board for Vocational Rehabilitation, such fact shall be certified to the Bureau of War Risk Insurance by said Board, and said Bureau may in its discretion withhold, in whole or in part, any compensation due to such person under this Act, or the said Act of Congress approved October 6, 1917, for the period during which such person fails to follow in satisfactory manner the said course or courses.

Section 4. That for the purpose of carrying out the provisions of this Act the President shall appoint a board, to be known as the Board for Vocational Rehabilitation, to be composed of one representative respectively of the Department of the Treasury, Department of War, Department of the Navy, Department of Labor, and Federal Board for Vocational Education. The Board shall annually elect one of its members as chairman and one as vice-chairman, and shall employ a director and such assistants, experts, and other employees as may be necessary to carry out the provisions of this Act, and fix their compensation. All persons employed by the Board in any capacity shall be appointed from the lists of eligibles to be supplied by the Civil Service Commission and in accordance with the Civil Service Law. All members of the Board shall serve without compensation, but all of the expenses of the Board including actual traveling and other necessary expenses incurred by the members of the Board, and by its employees under its orders, in making any investigation or upon official business in any other place than in the city of Washington, shall be allowed and paid on the presentation of itemized vouchers therefor properly approved.

Section 5. That said Board for Vocational Rehabilitation is authorized in its discretion to establish three advisory committees, one on agriculture, one on commerce and manufacture, and one on labor, such committees to consist of not more than five members and to be composed of persons having special ability and experience in regard to the training and employment of men in agriculture, industry, and commerce. All members of these committees shall serve without compensation but shall be allowed and paid actual traveling and other necessary expenses incurred in attendance upon committee meetings.

Section 6. It shall be the duty of the said Board to formulate, establish, and maintain courses of vocational rehabilitation; to prescribe and provide proper courses for such disabled persons discharged from, disenrolled from, or mustered out of the military and naval service of the United States as are ordered by the Bureau of War

Risk Insurance to follow courses of vocational rehabilitation; and to provide proper courses for other injured persons as hereinafter provided; to establish such schools as may be necessary to maintain such courses; to provide classes directly or in cooperation with and through schools and classes already established, whether public or private, or maintained in connection with industrial and commercial plants and establishments; to maintain or cause to be maintained courses of instruction for the preparation of teachers for vocational rehabilitation; to pay, when in the discretion of the Board such payment is necessary, the cost of travel, lodging, and subsistence of disabled persons pursuing courses upon the order of the said Bureau of War Risk Insurance; to provide for, or to cooperate with other agencies in providing for, the placement of rehabilitated persons in gainful occupations; and to do all other things necessary to carry out the purposes and provisions of this Act.

It shall also be the duty of the Board to make, or cause to have made, studies, investigations, and reports regarding the vocational rehabilitation of disabled persons and their proper employment. When the Board deems it advisable, such studies, investigations, and reports may be made in cooperation with or through other departments and bureaus of the Government, and the Board, in its discretion, may cooperate with or through such public or private agencies as it may deem advisable in executing the duties imposed by this Act.

Section 7. That all medical and surgical work or other treatment necessary to give, as far as possible, functional and mental restoration to disabled persons in the military service shall, prior to their discharge from such service, be directly under the executive control of the War Department and the Surgeon-General's Office of that Department; all such work or other treatment necessary to give functional and mental restoration to disabled persons in the naval service shall, prior to their discharge from such service, be under the executive control of the Navy Department and the Bureau of Medicine and Surgery of that Department; and all such work or other treatment necessary to give functional and mental restoration to disabled persons who have been discharged from the United States Military and Naval Service and require further treatment shall be under the executive control of the War Risk Insurance Bureau. Whenever pre-vocational training or other work, mental and manual, is employed by the Office of the Surgeon-General of the Army, by the Bureau of Medicine and Surgery of the Navy, or by the War Risk Insurance Bureau, as a therapeutic measure, a plan shall be arranged between each of these agencies and the Board for Vocational Rehabilitation, acting in an advisory capacity to insure, insofar as medical requirements permit, a continuous process of pre-vocational and vocational training, and the proper preparation of instructors for such training.

The said Board for Vocational Rehabilitation shall have power to make plans, rules, and regulations not inconsistent with law, necessary to carry into effect its duties as prescribed by this Act, and in order to avoid confusion and duplication of work the Board shall, in establishing its plans, rules, and regulations, cooperate with the Bureau of War Risk Insurance, the Office of the Surgeon-General of the Army, the Bureau of Medicine and Surgery of the Navy, and the Department of

Labor, insofar as may be necessary to effect said continuous process of pre-vocational and vocational training, and to provide for the return of rehabilitated persons to civil employment.

Section 8. That the said Board for Vocational Rehabilitation is hereby authorized and empowered to receive such gifts and donations from either public or private sources as may be offered unconditionally, and to expend or use the same in carrying out the purposes of this Act. All moneys received as gifts or donations shall be paid into the Treasury of the United States and shall constitute a permanent appropriation, to be called the "Special Fund for Vocational Rehabilitation," to be used under the direction of the said Board, in connection with the appropriations hereby made or hereafter to be made, to defray the expenses of providing and maintaining courses of vocational rehabilitation; and a full report of all gifts and donations offered and accepted and all disbursements therefrom shall be submitted annually to Congress.

Section 9. That the sum of ten million dollars is hereby authorized to be appropriated out of any money in the Treasury of the United States not otherwise appropriated, to be available until expended, to be used in the discretion of the said Board for the purpose of carrying out the general provisions of this Act.

Section 10. That for the fiscal year ending June 30, 1918, there is hereby authorized to be appropriated from any money in the Treasury of the United States not otherwise appropriated, the sum of two hundred thousand dollars for the administrative work of said Board, including salaries of officers and such assistants and clerks and other employees as the Board may deem necessary, and for actual traveling and other necessary expenses incurred upon official business, including attendance at meetings of educational associations and other organizations, rental of quarters in the District of Columbia and elsewhere, purchase of books of reference, law books and periodicals, stationery, typewriters and exchange thereof, miscellaneous supplies, postage on foreign mail, printing to be done at the Government Printing Office, and all other necessary expenses not hereinbefore mentioned.

Section 11. That the vocational rehabilitation which may be provided by the Board under the provisions of this Act shall, so far as practicable, and under such conditions as the Board may prescribe, be made available without cost for instruction to any person not embraced by the provisions of Section 1 of this Act, who, having been disabled in the line of duty while in the military or naval service of the United States, after he has been discharged from, disenrolled from, or mustered out of such service, may desire to avail himself of the same.

Upon the request of the United States Employees' Compensation Commission, such vocational rehabilitation shall be made available without cost for instruction for the benefit of any civil employee of the United States disabled while in the performance of his duty, and it may also be made available, in the discretion of the Board, under such conditions and on the payment of such fees as may be prescribed by regulations of the Board, for the benefit of any other person disabled in the course of employment or otherwise, if requested by any State compensation board or other State organization, or by any corporation, association, firm, or individual.

All money received by the Board as fees for courses of vocational rehabilitation as herein provided shall be paid into the Treasury of the United States and shall become a part of the "Special Fund for Vocational Rehabilitation" established by Section 8 of this Act, to be used as therein stated, and a detailed statement of all fees received and all disbursements therefrom shall be made annually to Congress.

Section 12. That Section 304 of an Act of Congress approved October 6, 1917, entitled, "An Act to Amend an Act Entitled, 'An Act to Authorize the Establishment of a Bureau of War Risk Insurance in the Treasury Department' approved September 2, 1914, and for other purposes," be and the same is hereby repealed.

5

PARISH REGISTER

OF THE

GERMAN REFORMED CHURCH

OF

ALEXANDRIA,

HUNTERDON COUNTY, NEW JERSEY.

1763-1802.

EDITED BY HENRY RACE, M. D.

FLEMINGTON, NEW JERSEY,
HIRAM EDMUND DEATS,
1900.

Number Eight

of twelve copies on Japan paper.

A C Weats

IT is not improbable that the pioneer German settlers of Alexandria and contiguous sections had a place for social worship, with an occasional preaching service in their own language, and at stated times at Mt. Pleasant previous to 1763. There is no record of their proceedings prior to that date. If any was kept, it has been lost. There were but few ministers in the Colonies at that period, and the infant Churches, struggling for existence, often waited several years before one could be obtained, even for a portion of his time, and a regular organization effected by the installation of a Pastor and Ruling Elders.

There was an English Presbyterian congregation at that place as early as 1752, as is shown by the Minutes of the Presbytery of New Brunswick, in which it is called "The Western Branch of Bethlehem;" and at a meeting held at Trenton, October 11, 1763, it was designated as "The Log Meeting House Congregation." It seems entirely probable that there was service in German in that "Meeting House" as early as there was in English. That the two congregations worshiped in the same house is evident from the language of the deed for the lot on which the succeeding edifice was built, which land was conveyed by Aaron Van Syckel and John Eckel to "The Trustees of the said Church and Congregation known as the Dutch (German) and English Presbyterian Church and Congregation of Alexandria." There was no occasion probably for disagreement between the two organizations relative to the occupancy of the pulpit. The Presbyterians and German and Dutch Reformed Protestants were so closely allied in doctrine as to cordially associate in worship and Christian fellowship in the sparsely settled localities of the pioneers, and the preaching services were too infrequent for any difficulty to arise about the use of the premises. The German pastor of the Alexandria Church became associated with the Churches of Rockaway (Lebanon), German Valley and Foxenburg (Fox Hill), and the Presbyterian with Bethlehem and Kingwood.

The old log Church stood about fifty yards from the site of the grist-mill on the road leading to the "Barrens," and near where Sylvester Martin's house stands. There was a graveyard near it, but no memorial stones remain. In digging the mill-race now in use, human bones were disinterred.

In 1795 a meeting of the two congregations was held, at which it was resolved that the old building was too much dilapidated for use, and that subscriptions should be solicited for money for a new house of worship. The business lingered and the new Church was not erected till 1802. It was located in the present cemetery, nearly opposite the site of the present Church. It was a frame structure and familiarly called the "New Frame," in distinction from the Bethlehem Presbyterian Church of that period, which was under the same pastorate and called the "Old Frame."

May 18, 1802, the German Reformed Synod, at the request of the congregation, transferred the Church to the care of the Presbytery of New Brunswick. The German language had become so much superseded by the English that the religious services thereafter were conducted in the latter tongue.

Many of the names in the register represent the lineal ancestors of families still living in this county. The variations which their orthography, in many cases, has undergone, is of interest to the genealogist as well as to the families to which they belong. The Abgerts have become Apgars ; Bellesfeldt is now Belfis ; Biekel is Piekel ; Bohn is called Bunn ; Blum is written Bloom ; Hausschild is Housel ; Holtxeiser, Hulsizer ; Jung, Young ; Ohlbach, Alpaugh ; Schmid, Smith ; Schneider, Snyder ; Ziedler, Sigler : and Schlaut, Slout.

The pastors of the German Reformed organization were Rev. Joseph Dallicker, V.D.M., in 1763 ; Rev. Caspar Wack, V.D.M., in 1783 ; and Rev. John Jacob Wack in 1795.

During the pastorate of Rev. Joseph Dallicker, 256 baptisms are recorded ; during that of Rev. Caspar Wack, 140 ; and during that of Rev. John Jacob Wack, 110 ; making 506.

Their services were conducted and Parish Register kept in the German language.

Parish Register.

October 14, 1763.

This book has been bought for 3 shillings and six pence for the use of this reformed congregation in Alexandria as a Church book. The elders of this congregation for the time being were chosen as follows :

1. Petei Dils. 2. Peter otto. 3. philippes schlaut. 4. Henrich reinschmit.

Anno 1771 the elders are :

Peter Dils, Phillip Schlaut, Abraham Jung, Hermet Schmid, Peter Ohlback.

Anno 1772.

Peter Dils, Abraham Jung, Hermet Schmid, Peter Ohlbach, Peter Blum.

Anno 1780.

Peter Dils, Abraham Jung, Hermet Schmid, Peter Blum, Paul Enders.

For the showing of your church furniture which belongs to this church and congregation, as follows : First, a book called Conraht Meets postill, concerning the gospels, cost seventeen shillings and six pence. Second, a cloth for the altar cost seventeen shillings. Third, a cup. Fourth, a contribution plate (salpleth) cost six shillings. Fifth, a baptismal bowl cost twenty pence.

Confirmations.

Confirmed March 29, 1769, through Fred Dalliker, V. D. M.

Elza Margaritha Bitzer,
Sabina Bohn,
Gertraud Casper,
Johannes Casper,
Johannes Dilts,
Eva Forschbach,
Conrad Huner,
Conrad Horn,
Jacob Hollenburger,
Maria Gertraud Hen,
Maria Schlaut,
Maria Catharine Schmid,
Maria Catharine Schmid.

19 May, 1771.

Wilhelm Blom,
Anna Margaritha Eberts,
Anna Friman,
Peter Hohlenburger,
Hannes Engel Jung,
Eva Jung,
Anna Maria Jung,
Elizabeth Jung,
Anna Margaritha Morkel,
Caspar Schmid,
Cornelius Schlaut,
Wilhelm Schmid,
Elisabeth Schmid,
Hannes Wels,
Maria Margaritha Weingarten,
Elisabeth Wels.

4 October, 1772.

Johannes Loesch and his wife, Anna Margaritha.

6 August, 1775.

Regina Bihm,
Adam Blum,
Peter Blum,
Frederich Ebcher,
Maria Enders,
Conrad Ebcher,
Johannes Eikel,
Peter Firshbach,
Wilhelm Firshbach,
Elisabeth Ohlbach,
Philip Schlaut,
Anna Maria Schmid,
Hermet Weingarten.

14 December, 1780.

Elizabeth Ebcher, wife of Friedrich.
Catharine Hen, wife of Wilhelm.
Jacob Jung and his wife, Maria.

7 April, 1782.

Margrith Bloom,
Jacob Enders,
Elisabeth Firschbach,
Paul Jung,
Maria Elisabeth Jung,
Catharina Kempel.

Marriages by John J. Wack, V. D. M. O., in Amwell and Alexandria.

1796, Nov. 10.—Charles Rockefeller and Charity Albach, both of Alexandria.

1795, Dec. 19.—George Lampen and Elisabeth Case, both of Alexandria.

1797, Aug. 24.—Peter Henn and Sally Penwell, both of Alexandria.

1800, Dec. 14.—Isaac Kitchen and Peggy Metler, both of Alexandria.

1801, Feb. 20.—James Cooley and Polly Wright, both of Alexandria.

BAPTISMAL RECORD.

BIRTH.	BAPTISM.	CHILD.	FATHER.	MOTHER.	WITNESSES.
Apr. 20.	June 2, 1763.	Peter.	Will. Wagner.	Cath. Kayser.	Peter Dels, Peter Bloom, Veronica Jung.
Apr. 28.	June 2, "	Elisab.	John Kirschbach.	Anna Magd. Schaeffert.	Will. Otto, Maria Elis. Dels.
Jan. 1.	" " "	Wilhelm.	Christ. Dels.	Anna Cath. Heids.	Will. Klein, Deothora Reinschmidt.
May 2.	July 11,	Maria.	Jo. Dels.	Mar. Margar. Blum.	Henr. Reinschmidt, Mar. Kreis.
June 10.	" "	Christ.	Jo. (?) Wagner.	Mar. Sophia (Apgar or Ahgen).	Christ. Badenheimer, Deothora Reinschmidt.
July 1.	Aug. 4, "	Jo. Herbert.	Paul Anders.	Gertrude Cath. Dels.	Jo. Herbert Schmidt, Vernon Jung, Anna Bolsin.
Feb. (?) 29.	Sep. 6,	Hinrich.	Conr. Klein.	Anna Henn.	Will. Klein, Elis. Cath. Klein.
Feb. 15.	Sep. 26,	Johan.	Wm. Ballesfeld.	Christine Lasley (?)	
Oct. 15.	" "		Cornel. Wagner.	Anna Elis.	
Aug. 23.	Oct. 10,	Maria.	Jo. Mich. Jung.	An. Quick.	Elis. Gerd. Badenheimer.
Jul. 11.	" "	Johannes.	Dan. Bauer.	Susannah Geber.	Jos. Rau.
March 29.	Jul. 9,	Maria Elis.	Abr. Jung.	Veronica Wagner.	Herbert Schmidt, Mar. Elis. Dels.
			PARENTS		
1763. Dec. 29.	Jul. 9,	Eva Elis.	Herbert Schmidt, Gertruth Richelem.		Paul Anders, Eva Blauen.
Nov. 3.	" "	Petrus.	Hinr. Creis, Maria Frey Eier.		Mar. Elis. Reinschmidt, Peter Bluhm, Veronica Jung.
May 1.	" "	Anna Margar.	Peter Aldag, Anna Engel.		Henr. Henn, Eva Mary Hollenburger, Anna Bitzer.
June 20.	" "	Christian.	Christian Badenheimer, Elis. Gerdr. Bohm.		Adam Wagner, Mar. Veronica Creis.
Feb. 6.	" "	Maria Elis.	John Inde, An. Elis. Deuschman.		Hinr. Kuntz, Mar. Elis. Reinschmidt and Mar. Marg. Dels.
Sep. 4.	Oct. 10,	Henrick.	Philip Schlaut, Maria Anna.		Henrick Kuntz & Veronica Jung.
1764. Sep. 25.	" "	Christ.	Conrad Weingarten, Maria.		Christ. Huner & A. Marg. Dels.
May 23.	" "	Anna Eva.	Phil. Kuhl, Catharine.		
Sep. 28.	" "	Anna.	Will. Henr. Otto, Maria Verena.		Hans Peter Otto, Anna Magdalena Hirschbach.
Sep. 15.	" "	Sophia.	Joh. Fred. Hill, Maria Elis.		Joh. Deotz and Anna Elis. Reinschmidt.
Oct. 1.	" "	Catharine.	Wilhelm Wagner, Catharina.		Paulus Biehm & Cath. Kuntz.
Aug. 19.	" "	Eva.	Peter Blum, Eva.		Ioost Schneider, Eva Wagner.
Apr. 20.	June 13,	Johannes.	Joh. Joost Schneider, Helena.		Johannes Wagner.
Nov. 16.	" " '65	Margaretta.	Peter Wagner, Eva.		Peter Blum.
Jul. 1.	" "	John Peter.	Peter Elschend, Elisabeth.		Johannes Peter Hahn & A. Margt. Hahn.
May 27.	Aug. 20,	Jannike.	Adam Schweihard, Elisabeth.		
July 31.	" "	Elisabeth.	John Will. Sehn, Anna Maria.		John Engel Jung & Elizabeth, his wife.
June 17.	" "	Anna Catharina.	Conrad Klein, Anna Abia (?)		Herbert Schmid & Anna Albach.
July 17.	" "	Maria Gertraud.	Peter Kemple, Maria Magdalena Gerhard.		Eva Schmid, Maria Veronica Otto.
June 11.	" "	Henrich.	Antonio Heller, Anna Christina.		Henrich Henn, Henrich Welter, Margaret Schneider
June 31.	" "	Anna Catharine.	Mattheus Brechtel, Anna Barbara.		Heinrich Weingarten. Anna Pitzer.
1765. Oct. 15.	May 6, 1766.	Henrich.	Joh. Engel Jung, Elisabeth.		William Otto & Maria Vronica, his wife.

BIRTH.	BAPTISM.	CHILD.	PARENTS.	WITNESSES.
Oct. 2.	" "	Eva.	Peter Casper, Anna Maria.	
1766. Feb. 17.	" "	Margaretha.	John Geist, Catharine.	Margaret Huner, William Huner.
April 1.	" "	Paul.	Philip Schmit, Maria.	Paul Anders, Eva Blum.
1765. June 1.	May 6, 1766.	Catharine.	Abraham Geiss, Anna.	John Engel Jung & Elisabeth, his wife.
1766. Feb. 18.	" "	Herbert.	Herbert Schmid, Gertraud.	
April 13.	" "	Anna Maria.	Peter Albach, Anna.	Paul Anders, Anna Maria Huner.
March 4.	" "	Henrich.	Michael Otto, Maria Vronica.	Henrich Henn, Gertraud & Cath. Anders.

Baptisms—J. G. Alsentz.

BIRTH.	BAPTISM.	CHILD.	PARENTS.	WITNESSES.
1766. June 25.	Aug. 26.	Paulus.	Henrich Salomon, Sabina Margaret.	Paul Anders, Anna Margt. Henn.
May 30.	" "	Johannes.	Roger Lorentz, Helena.	John Engel Jung & Elis., his wife.
Jul. 5.	" "	A. Maria.	Jacob Schrei, An. Catharine.	Peter Albach, Elis Jung & Maria Kemble.
Jul. 13.	" "	Jacob Henrich.	Joh. Jacob Eberts, An. Margaret.	Jac. Henrich Grau, A. Thiemat Casper.
Feb. 19.	" "	Jacob.	George Zingler, Elisabeth.	Jacob Boun, Cath. Eberts.
Oct. 6.	" "	Eva.	Conrad Weingarten, Maria.	Henr Reinschmit, Eva Blum.

Nov. 19.

Baptised by I. G. Alsentz.

BIRTH.	BAPTISM.	CHILD.	PARENTS.	WITNESSES.
Nov. 3.	Nov. 19.	Abraham.	Abram Jung, Veronica.	Will Wagner, A. Magd. Fursbachin.
Oct. 6.	" "	Elisabeth.	Peter Fein, Eva.	Abram. Jung, An. Elis. Jungin.
1767. Feb. 23.	Apr. 20.	Jacob.	John Ganch, Anna Maria.	I. Jac. Ebertz & A. Margaret, his w. & Jac. Rieder.
Mch. 10.	" "	Gertraut.	Christ. Patenheimer, Elis. Gertraut.	John Linnert, Gertraut Endris.
Feb. 20.	" "	Margreta.	Paul Endres, Gertraut.	
" 12.	" "	Magdalena.	John Dietz, Margrita.	Paul Linnert, Elisabeth Hunerin.
Dec. 5.	" "	Herman.	—— Wagner (?), An. Margrita.	Paul Linnert, Elisabeth Hunerin.
1766. " 9.	" "	Christian.	Peter Wagner, Eva.	Christian Huner, Eva Linnert.
1766 (?) May 29.	June 8.	Jacob.	Henrich Schneider (?), Elisabetha.	Chris. Patenheimers, Elis. Gertraut, his w.
May 15.	" "	Johan Henrich.	John William Sehn, Anna Maria.	
April 11.	July 8.	Catrina.	Adam Schweigert, Elisabeth (?).	
June 21.	" "	Anna.	Just Fwischbach, A. Magdalena.	Paul Enders, Gertraut Furschbachin.
Jul. 13.	Aug. 16.	Herbert.	Peter Blum, Eva.	Herbert Schmit, Elisabeth Jungin.
Jul. 27.	" "	Tonpes.	John Holler, ——.	Joupes Holler and Elisabeth, his wife.
Feb. 25.	" "	Daniel.	Jacob Wier, ——.	
Sep. 22.	Oct. 5.	Abraham.	Joseph Schneider, Helena.	Abraham Jung & Gertranut Catharina, h. w., Paul Enders.
1767. Sep. 12.	" "	Catrina.	Joh. Peter Kimpel, Maria Magdalena.	Peter Schmit, Catharina Hennin.

	Oct. 19.	Dec. 13.	Joh. Wilhelm.	Joh. Friderich Still, Maria Elisabeth.	John Will. Hiner, John Will. Otto, Veroniea Jungin.
1768.	Jan. 28.	Feb. 21.	Maria.	Joh. Engel Jung, Anna Elisabeth.	Peter Blum, Maria Elis. Bun.
1767.	Aug. 8.	Apr. 3, '68.	Catharina.	William Murgel, Margaretha.	Mathis Schmid, Catharina Reinschmid.
1768.	Mar. 2.	May 8.	Eva.	John Kreis, Catarina.	Peter Huner, Eva Blum.
	May 3.	June 11.	Joh. Wilhelm.	Herbert Huner, Maria Elisabeth.	Wilhelm Huner, Gertraud Enders.
	May 19.	June 11.	Eva Catharina.	Paul Boehm, Ana Catharina.	Jost Furstbach, Margaritha Lischin.
1767.	Jul. 2.	Jul. 3.	Joh. Peter.	Peter Rimer, Elisabetha.	Hanes Gedert, Catharina Trumer.
	June 1.	" "	Catharina.	Herman Dils, Christina.	Hanes Dils, Catharina Dils.
1768.	May 30.	" "	Anna Maria.	Joh. Peter Bezer, Maria Elisabeth.	William Hen. Bezer, Maria Hollenberger, Anna Maria Gey.
1768.	May 2.	Jul. 3.	Elsa Catharina.	Heinrich Kirchhofer, Anna Dimath Casper.	Jacob Hollenberger, A. Cathar. Bitzerin.

On the 3rd of July an illegitimate child was baptized, after the mother, in the presence of her father, of the whole church council and myself.

1768.	Aug. 14.	Sep. 4.	Maria Elis.	Conrad Weingarten, Maria Grith.	Bernard Mathias, Gertraud Feuschbach.
	Aug. 6.	" "	Catharina.	Dunes Eieh, Catharina.	
	Feb. 4.	" "	Margarith.	Cornelius Hoff, Margarith.	
	Jul. 2.	Sep. 25.	Wilhelm.	Peter Wagner, Eva.	William Huner, Gertraud Weingarten.
	Aug. 5.	" "	Eva Maria.	Peter Fahman, Maria.	Peter Blum & Eva, his w.
	Sep. 24.	Oct. 16.	Joh. Wilhelm.	Wilhelm Otto, Maria Veronica.	Hanes Wilhelm Otto, Maria Magdalena Kempel.
	Sep. 28.	" "	Gertraud.	Hermet Schmid, Gertraud.	Maria Veronica Otto, Peter Blum.
	Sep. 17.	" "	Elisabeth.	Jacob Bohn, Elisabeth.	Georg Ziegler, Elisabeth Jung.
	June 3.	" "	Adam.	George Ziegler, Elisabeth.	
	Sep. —.	" "	Margrita.	Antoni Myller, Barbara.	Jacob Myller, Maria Margaretha, his w.
	Oct. 23.	Nov. 22.	Johannes Peter.	Peter Ohlbach, Anna.	Engel Jung, Gertraut Schmit, Johannes Peter Hen.
	Oct. 24.	" "	Johannes.	Jacob Roter, Maria Elisa.	Johannes Ord, Agnes Catarina Ordin.
	Oct. 30.	" "	Maria Elisab.	Jacob Schrei, Anna.	Johannes Linerd, Maria Elisabeta Cornin.
1768.	Oct. 25.	Feb. 3.	Catrina.	—— Horninger, Margrita.	Adam Lot, Catharina Ewerts.
1769.	Jan. 25.	Mch. 12.	Peter.	Joh. Wilh. Sein, Anna Maria.	
1769.	Feb. 14.		Sophia.	Johannes Dils, Margarita.	
	Feb. 23.	Mch. 24.	Johannes.	Christian Lindener, Anna Elisab.	
	Apr. 1.	May 7.	Gertraud.	Paul Enders, Gertraud.	Peter Schmid, Gertraud Ferschbach.
	Mch. 23.	" "	Paulus.	Peter Blum, Eva.	Paul Enders, Lena Forshbach.
	Jan. 23.	" "	Elisabeth.	Matheis Schwick, Elisabeth.	Julianna Dinstman.
	Apr. 17.	June 4.	Catrina.	Johannes Luesch, Margrita.	Paulus Boehm & Anna, his w.
	May 17.	Jul. 2.	Anna Maria.	Wilhelm Morgel, Margarita.	
	June 4.	" "	John Peter.	Hannes Haas, Rosina.	
	June 3.	" "	Jacob.	Heinrich Weingarten, Eva.	Jacob Hohlenberger, Maria, his wife.
	July 23.	Jul. 30.	Christian Alexander.	Christian Alexander Rorbacher, Hanetta Jacobina.	Christian Lindner, Ana Elisabeth, his w., Maria Margaretha Lisching.
	Mch. 19.	Jun. 19.	Peter.	Abraham Jung, Veronica.	Peter Blum & Gertr. Enders.
	Sep. 1.	Sep. 24.	Philip Heinrich.	Hannes Creis, Catharina.	Philip Sehlaut, Catharina Ottin.
	Aug. 27.	Oct. 27.	Margarita.	Dunes Huller, Christina.	Teis Bekman, Margarita Huner.
1769.	Nov. 2.	Dec. 10.	Johan. Peter.	Joh. Peter Bitzer, Maria Elisab.	Johannes Gey, Peter Wilhelm Fisher (?), Sophia Bohn.

Birth.	Baptism.	Child.	Parents.		Witnesses.
1770. Jan. 10	Feb. 11.	Anna Maria.	Frederick Still, Maria Elisabeth.		Conrad Huner, Ana Maria Schlaut.
1769. Nov. 2.	Mch. 9.	Georg.	Peter Friz, Christina.		Wilhelm Billesfeld, Christina, his w.
Jan. 6.	Mch. 9.	Conrad.	Wilhelm Billesfeld, Christina.		Conrad Casper, Ana Maria Casper.
1769. Aug. 1.	" "	Hannes.	Andreas Wridling, Cath. Barbara.		Hannes Wridling, Hannah, his w.
June 22.	" "	Elisabeth.	Hannes Wridling, Anna.		Christian Lindner, Elisabeth, his w.
1770. Mch. 19.	April 14.	Heinrich.	Hermet Huner, Maria Elisab.		Heinrich Reinschmid, Gertraud Schmid.
1769. Nov. 21.	May 27.	Jacob. Heinrich. Adam.	Peter Rimer, Elisabeth (retain).		
Aug. —.	" "	Wilhelm.	Herbert Trummer, Catharina.		
1770. Mch. 25.	" "	Elisabetha.	Joseph Schneider, Helena.		Conrad Casper, Elisabeth Lindner, Elisabeth Olp (?)
May 2.	" "	Elisabeth.	Christ. Hoffman, Dimet.		Conrad Casper, Elisabeth Lindner, Elisabeth Olp (?)
1770. June 1.	June 17.	Wilhelm.	Jacob Roeder, Maria Elisab.		Wilhelm Jung, Elisabeth Jung.
			Father.	Mother.	
1770. May 8.	June 17.	Hannes Wilhelm	Peter Kempel.	Maria Magdalena.	Joh. Engel Jung, Wilhelm Hen, Gertraud Henin.
Dec. 5	July 8.	Johannes.	Heinrich Schafer.	Elisabeth.	Johannes Liuert, Maria Cath. Schmid.
June 24.	July 29.	Anna Magarith.	Theis Bachman.	Anna Maria.	Hermet Schmid, Anna Christina Hillerin, Anna Maria Schmid.
1770.	Aug.	Edna Eva.	Conrad Weingarten.	Margarith.	Frederich Still, Anna Bihm, Eva Forschbach.
June 18?	" "	Anna.	Peter Wagner.	Eva.	Dunes Hiller, Christina, his w.
		Christina.			
Aug. 30.	Sep. 8.	Conrad.	Ernst Sterker.	Gertraud.	Conrad Casper, Anna Marg. Huner.
Aug. 27.	Sep. 30.	Herbert.	Wilhelm Hein Otto.	Veronica.	Hermet Schmid, Gertraud Cath. Forschbach.
Sep. 1.	" "	Johannes.	Frederich Jordan.	Catharina.	
"	" "	Anna Maria.	Anton Muller.	A. Barbara.	Conrad Casper, A. Margaretha, his w., A. Margaretha Muller.
	'63.				
1762. Oct. 12	Oct. 1.	Maria).	Hieronymus Van Est.	Beschentia (?)	
1767. Dec. 20.	" "	Judic).			
1769. Nov. 7.	" "	Ephes).			
1770. Oct. 26.	Jan. 14.	Hannes Peter.	Jacob Bon.	Maria Elisab.	Hannes Peter Hen, Elisabeth Jung.
1770. Oct. 15.	Jan. 14.	Matteis.	Jost Forschbach.	Anna Magdalena.	Theis Schmid, Eva Jung.
Dec. 8.	" "	Han Theis.	Peter Ohlbach.	Anna.	Han Peter Hen, Elisabeth Bon.
Nov. 14.	" "	Anna Elisabeth.	Heinrich Weingarten.	Eva.	Jacob Hohlenberger, Elisabeth Jung.
Oct. 28.	" "	Anna Margarith	Christ. Huner.	A. Margarith.	
1771. Jan. 16.	Feb. 25.	Joh. Paul.	Paul Bihm.	Anna.	Paul Enders, Gertraud Firshbach.
Jan. 26.	" "	Anna Maria.	Peter Blum.	Eva.	Hannes Peter Huner, Anna Maria Jung.
Jan. 12.	Mch. 18.	Joh. Heinrich.	Joh. Gerlack Horn.	Elisabeth.	Conrad Horn, Gertraud Weingarten.
April 3.	Apr. 28.	Antoni.	Joh. Peter Bitzer.	Maria Elisabeth.	Antoni Cramer, A. Maria Bitzer.
April 4.	Apr. 29.	Abraham.	Hermet Schmid.	Gertraud.	Abraham Jung, A. Magdal. Firschbach.
April 7.	" "	Abraham.	Paul Enders.	Gertraud.	Abraham Jung, Eva Bloom.

	Mch. 17.	" "	Elisabeth.	Wilhelm Morkel.	A. Margaritha.	
	"	Apr. 30.	Johannes.	Peter Itland (?).	Elisabeth.	Wilhelm Billesfeld, Christina, his w.
	April 12.	" "	Eva.	Christian Lindner.	Elisabeth.	
1771.	April 1.	Apr. 30.	Anna.	Bernhard Olp.	Eva Elizabeth.	David Sasseman, Anna, his w.
	April 14.	May 2.	Hannes.	Hannes Haman.	Maria.	Hannes Engel Jung, A. Maria Welsin.
	April 19.	June 9.	Elisabeth.	Wilhelm Hofman.	Anna.	
	Jul. 16.	Jul. 22.	Magdalena. Sara.	Abraham Jung.	Veronica.	
	June 19.	Aug. 11.	Johannes.	Johannes Lisch.	M. Margaritha.	John Liseh, Senior, Catharina, his w.
	May 10.	" "	Matteis.	Jacob Schrey.	A. Catharina.	Matteis Brachly, Marey Lienerd.
	Jan. 12.	" "	Johannes.	Andris Perton (?)	Elsa.	Hannes Person, Maria Scharfenstein.
1771.		Sep. 1.	Dorothea.	Hannes Dills.	M. Margaritha.	
	Aug. 1.	Sep. 3.	A. Maria.	Heinrich Weingarten.	Elsa Margaritha.	Hermet Weingarten, Margaritha A. Cath. Eberts.
1771.	June 13.	Oct. 13.	Wilhelm.	Wilhelm Kempels.	Elisabeth.	
1771.	Nov. 20.	Jan. 26.	Christ.	Herbert Huner.	M. Elisabeth.	
		1772.				
1771.	Dec. 4.	" "	Herberth.	Christ. Huner.	A. Margarith.	
1772.	Jan. 2.	Jan. 27.	Hannes Peter.	Nannes Creis.	Cath. Elisabeth.	
1771.	Oct. 28.		Abraham.	Hannes Haas.	Rosina.	
	Dec. 16.	Mch. 9.	Matheis.	Joh. Engel Jung.	Elisabeth.	Matheis Brechli, Anna Ohlbach.
1772.	Jan. 10.	" "	Peter.	Wilhelm Bitzer.	Maria.	Peter Ohlbach, Peter Wilhelm Bitzer, A. Cath. Bitzerin.
1772.	Mch. 5.	April 21.	David.	Wilhelm Billesfeld.	Christina.	Peter Casper & A. Maria, his w.
	Mch. 16.	May 20.	Joh. Peter.	Michael Fizer.	Veronica Cath.	Han Peter Weingarten, Peter Hohtenberger, Eva Weingarten.
	Feb. 25.	" "	Gertraud Cath.	Conrad Weingarten.	Grith.	Hermet Weingarten, Gertr. Cath. Enders.
	Mch. 24.	" "	Maria.	Johannes Linerd.	Elisabeth.	
	Jan. 2.	May 31.	Maria.	Joh. Michael Ihl.	Eva.	Maria Lienerd.
	June.	Aug. 2.	Johannes.	Hanes Wudling.	Anna.	Lem. Hofer, Eva Raup.
	Jan. 30.	" "	Elisabeth.	Dnnes Hiller.	Etna (?).	Wilhelm Otto, Elis. Schmid.
	Jul. 19.	Aug. 3.	Hermet.	Matheis Schmid.	Catharina.	
	Jul. 14.	Aug. 3.	Anna Maria.	Conrad Casper.	Catharina.	
	May 11.	Aug. 27.	Conrad.	Andres Wndling.	Catharina.	Conrad Casper, Maria Magdal. Muller.
	May 10.	" "	Anna.	Jean Verot.	Maria.	Bernhard Olp, Elisabeth, his w.
	Aug. 4.	Aug. 25.	Hannes Peter.	Heinrich Weingarten.	Eva.	Hannes Engel Jung, Junior, Peter Hohlenberger, Maria Weingarten.
	3 years	old Oct. 1.	Sophia.			
	Sep. 5.	Oct. 5.	Anna Maria.	Ernst Sterker.	Gertraud.	David Sasseman, A. Maria Casperin (?).
	Aug. 27.	Oct. 25.	Frederick.	Frederick Jordan.	Catharina.	
1772.	Aug. 27.	Oct. 25.	Jacob.	Joseph Schneider.	Lena.	
	Oct. 2.	" "	Hannes Wilhelm	Hanes Peter Huner.	M. Cathar.	Wilhelm Schmid, A. Maria Huner.
	Sep. 22.	" "	Gertraud.	Theis Bachman.	Eva Maria.	Joh. Gey, Gertraud Schmid.
	Sep. 28.	Oct. 25.	Jacob.	Peter Ohlbach.	Anna.	
1771.	Oct. 15.	Nov. 15.	Wilhelm.	Peter Hanschild.	Maria.	Wilhelm Hofman, Anna, his w.
		1772.				
1772.	Sep. 8.	" "	Jacob.	Frederich Still.	Maria.	Jacob Brunner, Magdalena, his w
	Oct. 23.	Nov. 16.	Johannes.	Peter Bloom.	Eva.	

BIRTH.	BAPTISM.	CHILD.	FATHER.	MOTHER.	WITNESSES.
Oct. 4.	“ “	Joh. Heinrich.	Jacob Bonn.	Maria Elisab.	Heinrich Behl, Elisabeth Ohlbach.
Sep. 10.	“ “	Daniel.	Jacob Roder.	Maria Elisab.	
1773. Feb. 6.	Mch. 21.	Abraham.	Welhelm Heinrich Otto.	Maria Veronica.	Abraham Jung, Ana Veronica.
Jan. 1.	Apr. 11.	Johannes.	Christopher Schriys.	Cath. Henrica.	
1772. Oct. 7.	“ “	Joh. Adam.	Jacob Humerich.	Eva Gertraud.	
1772. Dec.	“ “	Wilhelm.	Heinrich Hen.	Elisabeth.	
1773. Jan. 2.	“ “	A. Catharina.	Hannes Peter Bizer.	M. Elisabeth.	Richard Bohm, Anna Julia (?), his w., Anna Cath. Bohm.
1768. July 7.	April 12.	Johanas.	Theis Brand.	Maria.	
1771. June 3.	“ “	Elsa Maria.	“ “	“	
1773. April 7.	May 2.	Paulus.	Paul Enders.	Gertr. Catharina.	Paul Bihm, Anna Ohlbach.
Mar. 4.	May 23.	Anna.	Paul Bohm.	Anna.	
1773. Oct. 10.	May 23.	Johannes.	Joh. Peter Oettgen.	Anna Maria.	John Becher, Elis Becher.
June 8.	July 25.	Maria Barbara.	Friderich Ebeher.	Elisabeth.	Peter Holenburger, Anna Maria Filhauer, A. Barbara Brechley.
Mar. 2.	Aug. 15.	Maria.	Gerhard Lehr.	Elisabeth.	
Aug. 4.	Sep. 26.	Conrad.	Wilhelm Bitzer.	Maria.	Conrad Casper, A. Margarith, his w.
July 8.	“ “	Peter.	Gerlach Horn.	Elisabeth.	
Sep. 6.	Sep. 27.	Paulus.	Hermeth Schmid.	Gertraud.	Paul Enders, Veronica Jungin.
1770. Nov. 27.	Oct. 17.	Joh. Heinrich.	Christian Mann.	Anna.	Joh. Theis Brand, A. Maria, his w.
	1773.				
1773. Feb. 11.	“ “	Johannes.	“ “	“	Joh. Bihmer. A. Maria, his w.
Feb. 11.		A. Elisabeth.	“ “	“	Ferdinand Shrofe, A. Elisab. Brand.
1773. Dec. 21.	Jan. 30.	Barbara.	Balthes Christ.	Catharina.	Matheis Brechley, Anna Barbara, his w.
	1774.				
1774. Jan. 20.	Mch. 13.	Wilhelm.	Christ. Huner.	A. Margarith.	
Feb. 8.	“ “	Abraham.	Peter Schmid.	Eva.	Abraham Jung, Gertraud Schmid.
Jan. 4.	Mch. 14.	A. Margrith.	Antony Hofman.	Gertraud.	Hermeth Weingarten, A. Margarith, his w.
1773. Nov. 5.	Apr. 1.	A. Catharina.	Ludwig Wildanger.	A. Maria.	Adam Reifner, Cath. Bitzerin.
	1774.				
Oct. 18.	“ “	Catharina.	Hannes Lienerd.	Elisabeth.	
Mch. 9.	“ “	A. Gertraud.	Hannes Peter Huner.	M. Catharina.	Paul Enders, A. Gertr. Schmidin.
Dec. 21.	April 21.	Elisabeth.	Peter Wagner.	Eva.	
	1774.				
1774. April 17.	May 15.	Catharina.	Heinrich Weingarten.	Eva.	George Clas, Cath. Jordan.
April 3.	“ “	A. Catharina.	Johannes Geig.	A. Maria.	Cath. Hen, Margrit Eberith.
Feb. 21.	Aug. 28.	Jacob.	Jacob Schrey.	A. Catharina.	Jacob Bon, Jacob Rider.
Aug. 1.	“ “	Hannes Peter.	Peter Hohlenburger.	Maria Grith.	Hermet Weingarten, Gertraud Hofman.
June 21.	“ “	Abraham.	Conrad Weingarten.	Maria Grith.	Abraham Jung, Magdalena Firshbach.
June 14.	“ “	Hannes Peter.	Ernst Sterker.	Gertraud.	Peter Casper, Anna Maria, his w.
June 9.	“ “	Maria Rosina.	Jacob Bonn.	Mar. Elisab.	

Aug. 8.	Aug. 29. (?)	Jacob.	Peter Blum.	Eva.	Jacob Jung, Gertraud Enders.
Aug. 22.	Sep. 17.	Apollona.	Jacob Reder.	Mar. Elisab.	
1775. April 14.	June 8.	Wilhelm.	Paul Enders.	Gertraud.	Wilhelm Schmid, A. Magdalena Firshbach.
May 29.	" "	Johannes	William Bitzer.	Maria.	Johanes Peter Lenz, Heinrich Weingarten, Margarith Ebert.
1775. Mar. 19.	June 8.	Anton.	Anton Hiller.	Anna Christina.	Eva Wagner.
May 14.	" "	Gertraud.	Peter Ohlbach.	Ana.	Wilhelm Ditzer, Gertraud Enders.
April 13.	" "	Sophia.	Hannes Lienerd.	Elisabeth.	
March 3.	Jul. 27.	Johannes.	Geret Leer.	Elisabeth.	
April 22.	" "	Heinrich.	Joseph Schneider.	Lena.	
May 31.	" "	Elisabeth.	Wilhelm Schneider.	Sara.	Bunes Hiller, Eva Schneider.
1771. Nov. 18.	Aug. 1.	Ester.	Joseph Kefly (?).	Rebecca Fridey.	Matheis Brechly, A. Barbara, his w.
	1775.				
1774. May 20.	Aug. 5.	Sara.	Michel Fezer.	Veronica.	Wilhelm Schmid, Sabina Bihm.
1775. July 9.	Aug. 5.	Peter.	Adam Lienerd.	Elisabeth.	
Oct. 30.	" "	Gertraud.	George Weid.	Eva Maria.	Peter Blum, Gertraud Sterker.
Aug. 9.	" "	Anna Eva.	Friderich Ebcher.	Elisabeth.	Jacob Honlenburger, Anna Eva Elasin.
Aug. 5.	" "	Gertraud.	Peter Schmid.	Eva.	Hernet Schmid, Gertraud Enders.
1777. Oct. 24.	Mch. 19.	Peter.	Peter Schmid.	Eva.	Peter Bloom, Anna Jung.
1776. Dec. 6.	" "	Hermet.	Wilhelm Schmid.	Regina.	
5 years old.		Peter.	Niclas Heid.	Rithel (?)	Jacob Hohlenburger, Maria, his w.
1776. June 24.	Mch. 19.	Elisabeth.	Jacob Rider.	M. Elisabeth.	George Horn, Elisabeth, his w.
1777. Feb.	" "	Catharina.	Friderich Ebcher.	Elisabeth.	George Clas, Cath. Humerich.
1776. Sep. 1.	Mch. 19.	Maria.	Jacob Hohlenburger.	M. Gertraud.	Jacob Hohlenburger, Maria, his w.
" Nov. 3.	" "	A. Margrith.	Hannes Peter Huner.	M Catharina.	Hermet Schmid, A. Maria Schlaut.
Sep. 26.	" "	Ana.	Paul Enders.	Gertraud.	Peter Casper, A. Magdal. Firshbach.
March 6.	" "	Samuel.	Gered Leer.	Elisabeth.	
March 31.	April 22.	Peter.	Johannes Casper.	Elisabeth.	
1775. Aug. 13.	" "	Maria.	Paul Bohm.	A Catharina.	Johanes Muller, Magdalena, his w.
1777. Sep. 28.	Oct. 26.	Abraham.	Hannes Peter Huner.	M. Catharina.	Abraham Jung, Gertraud Enders.
June 29.	" "	Gertraud.	Casper Schmid.	Maria.	Gertraud Schmid.
1777. " 15.	15.	Gertraud.	Christopher Houner.	A. Margaret.	
1778.	15.	Gertraut.	Hannes Casper.	Gertraut.	Heinrich Weingarten, Eva Weingarten.
Mch.	May 5.	Johannes.	Jacob Stoll.	Rachel.	Wilhelm Haag, Rachel, his w.
June 22.	Aug. 15.	Peter.	Peter Wagner.	Eva.	Peter Bloom, jun., Maria Lienerd.
April 1.	" "	Elisabeth.	Hannes Lienerd.	Elisabeth.	
July 15.	" "	Maria Catharina.	Adam Lienerd.	Elisabeth.	
Aug. 1.	Oct. 8.	Peter.	Wilhelm Schmid.	Regina.	Peter Schmid, Gertr. Caih. Enders.
June 30.	" "	Margrith.	Wilhelm Haag.	Eva.	
1778. Sep. 6.	Oct. 8.	Catharina.	Jacob Hohlenburger.	M. Gertraud.	Hannes Peter Lenz, Cathar., his wife.
1779. Mch. 19.	Apr. 15.	Adam.	Paul Enders.	Gertraud.	Adam Lienerd, Eva Firschbach.
1778. Oct. 7.	" "	Wilhelm.	Peter Schmid.	Eva.	Wilhelm Schmid, A. Veronica Jung.
1779. Feb. 2.	" "	Gertraud.	Adam Bloom.	Maria.	Peter Bloom, Gerhard Enders.
1778. Oct. 20.	" "	Eva.	Friderich Ebcher.	Elisabeth.	George Clas, Anna Eva, his w.
Oct. 31.	" "	Ana.	Wilhelm Bloom.	Maria.	Peter Bloom, Anna Ohlbach.
1779. Sep. 10 (?)	May 2.	Christian.	Peter Bloom.	Anna Eva.	

BIRTH.	BAPTISM.	CHILD.	FATHER.	MOTHER.	WITNESSES.
	1780.				
Aug. 25(?)	May 2.	Hannes.	Casper Schmid.	Maria.	
	" "	Joh. Peter.	Matheis Bekman.	Eva Maria.	Hannes Peter Enders, Eva Firschbach.
	" "	Han Heinrich.	Heinrich Weingarten.	Eva.	Catharina Brinkmanin.
1780. April 20.	June 6.	Matheis.	Jacob Bonn.	M. Elisabeth.	
April 9.	" "	Joh. Georg.	Joh. Gerlich Horn.	Elisabeth.	
Jan. 15.	" "	Paulus.	Johannes Lienerd.	Elisabeth.	
1779. Dec. 16.	" "	Elisabeth.	Hannes Peter Huner.	M. Catharina.	Philip Schlaut, Elisabeth Schmid.
1780. July 3.	Aug. 1.	Philip.	Hannes Eckel.	Elisabeth.	
Jul. 9.	" "	Maria.	Adam Bloom.	Maria.	Wilhelm Bloom, Maria Jung.
Aug. 10.	Sep. 26.	Isac.	Wilhelm Bloom.	Maria.	
1780. Aug. 31.	Oct. 17.	Abraham.	Wilhelm Schmid.	Regina.	Abraham Jung, Barbara Brachly.
Sep. 17.	" "	Maria Catharina.	Peter "	Eva.	Jacob Jung, Maria Huner.
Sep. 11.	" "	Anna.	Dunes Hiller.	A. Christina.	Peter Schmid, Margrith Haupt (?).
Aug. 6.	Dec. 14.	Joh. Georg.	Hannes Haman.	Ana Maria.	
				1781.	
1781. Feb. 28.	Mch. 15.	Jacob.	Jacob Reder.	Maria Elisab.	
" Dec. 17.	" "	Wilhelm.	Niclas Sein.	Maria.	
Sep. 15.	" "	Wilhelm.	Wilhelm Haag.	Eva.	Wilhelm Firshbach, Grit Lis Enders.
Jan. 19.	" "	Anna.	Jacob Holenburger.	M. Gertraud.	Heinrich Weingarten, Anna Ohlbach.
1779. June 29.	" "	Catharina.	Adam Wagner.	A. Maria.	Philip Schlaut.
Feb. 22.	" "	Anna.	Jacob Jung.	Maria.	Joseph Firshbach, Anna Jung.
1778. Aug. 21.	May 31.	Antony.	Peter Hiller.	Anna.	Anton Miller, Christina, his w.
	'79.				
1780. Sep. 9.	" "	M. Margarith.	" "	"	. Margrith Casper.
Jun. 15.	Aug. 2.	Geor Adam.	Jacob Crazly.	A. Margrith.	
April 20.	" "	Isac.	Paul Bihm.	A. Cathar.	
Aug. 9.	Sep. 6.	Friderich.	Friderich Ebcher.	Elisabeth.	
June 30.	Nov. 23.	Wilhelm.	Adam Wagner.	A. Maria.	Wilhelm Bloom, Eva Schmid.
				1782.	
1781. Nov. 19.	June 10.	Maria.	H. Peter Huner.	M. Catharina.	Peter Schmid, Maria Bloom.
Mch. 5.	Apr. 6.	Paul.	Adam Bloom.	Maria.	Paul Enders, Eva Bloom.
1781. Sep. 1.	" "	Susanna.	Casper Schmid.	Susanna.	Joh. Martin, Susanna, his w.
1782. Jan. 1.	" "	Susanna.	Matheis Bekman.	Eva Maria.	Maria Bloom.
Dec. 26.	Apr. 7.	Gertraud.	Niclas Sein.	Maria.	
April 17.	Oct. 9.	Wilhelm.	Wilhelm Bloom.	Maria.	Wilh. Firschbach, Eva Bloom.
Sep. 11.	" "	Maria Catharina.	Wilhelm Schmid.	Regina.	Paul Enders, M. Cath. Huner.
Oct. 1.	" "	Anna Lis.	Charles Horn.	Elisabeth.	
				1783.	
1782. Aug. 29.	June 28.	Joh. Herbert.	Peter Shmith.	Eva.	Herbert Shmith, Regina Shmith.

Nov. 22.	" "	Jacob.	Peter Wagner.	A. Eva.	Maria Schlantin.
1783. Jan. 18.	" "	Catharina.	Jacob Jung.	Maria.	Wilhelm Otto, Cath. Lantzin.
1783. Sep. 25.	Nov. 22.	Cornelius.	Benjamin Lau.	Elisabeth.	
Oct. 5.	Dec. 10.	Maria.	Philip Bellas.	Maria.	
Jan. 28.	" "	Peter.	Peter Bellas.	Allis.	Paul Andres, Gertraut, his w.
Nov. 30.	" "	Gertraut.	Herbert Andres.	Elisabeth.	" "
1783. Aug. 16.	Dec. 10.	Adam.	Dennia Heller.	Anna.	
Oct. 24.	" "	Anna.	Joh. Peter Lentz.	Catharina.	Jos. (?) Ohlbach and w.
1783. Nov. 8.	Dec. 10.	Anna.	Adam Lennard.	Elisabeth.	
Aug. 18.	" "	Jacob.	Jacob Holleberger.	Maria Gertraut.	
Nov. 1.	" "	Matheus.	Jacob Gratij. (?)	A. Margaretha.	Matheus Brechly and w.
May 5.	" "	Johann Phillip.	Jacob Lunnerd.	M. Elisabeth.	
April 3.	" "	Adam.	Henrich Weingarten.	Eva Margretha.	Anna Allebachin.
			17	85	
1784. June 17.	Aug. 8.	Elisabeth.	Casper Shmidt.	Maria.	Paul Enders and w.
1785. July 31.	" "	Peter.	Adam Blum.	Maria.	Peter Blum, A. Eva Jung.
1784. Sep. 24.	" "	Elisabetha.	Jacob Enders.	Catharina.	Paul Enders and w.
1785. July 13.	" "	Abraham.	Adam Jung.	Margaretha.	Abraham Jung and w.
1785. Dec. 15.		Anna.	Joh. Peter Honer.	M. Catharina.	Peter Blum, Anna Christianna Hiller.
1785. Feb. 27.	Aug. 8.	Anna.	Herbert Enders.	Elisabetha.	Adam Blum, Anna Jung.
March 3.	" "	Elisabetha.	Martin Jordan.	Eva.	John Eckel and Elisabetha.
July 18.	" "	Eva.	Henrich Weingarten.	Eva.	Martin Jordan, Eva, his w.
July 6.	" "	Anna.	Joseph Shlatter.	Margaretha.	Peter Bluhm and w.
Mch 28.	" "	A. Christina.	Peter Hiller.	Anna.	Antony Hiller and Christina his w.
1783. Sep. 10.	" "	Anna Maria.	Adam Waggener.	Maria.	Peter Bluhm, Veronica Jungin.
1785. Aug. 3.	Aug. 9.	Johannes.	Johannes Eckel.	Elisabeth.	Johannes Eckel, Catharina Jordinin.
July 26.	" "	Abraham.	Jacob Jung.	Maria.	Abraham Jung, Gertraut Endressin.
1785. Aug. 30.	Oct. 10.	Phillipus.	Phillip Slaut.	Elisabeth.	Philip Shlant, Eva Maria, his w.
Sep. 8.	" "	Jacob.	Johann Peter Lantz.	Catharina.	Jacob Jung, Paul Beam's wife.
Sep. 9.	" "	Anna.	Paul Jung.	Elisabeth.	Joseph Forschbach, Anna Jungin.
1784. Oct. 22.	" "	Johannes.	Wilhelm Shmiedt.	Regina.	
Nov. 14.	" "	Maria.	Joh. Christ. Haner.	Susanna.	
1780. Dec. 30.	Nov. 31. 1781	Joh. William.	Peter Blum.	Magdalena.	Abraham Bluhm, Magdalena, his w.
1784. Jan. 3.	Dec. 31.	Petrus.	" "	"	Peter Blum and Eva his w.
			17	86	
1786. Feb. 14.	June 15.	Abraham.	Dennis Heller.	A. Christina.	Abraham Jung, Agnes Shoemacher.
1784. Mch 7.	June 15.	Wilhelm.	Jacob Hauschild.	Anna.	
1786. Mch 7.	" "	Johannes.	" "	"	
1785. Aug. 20.	" "	Anna.	Peter Schmiedt.	Eva.	Paul Jung, Eva Blum.
April 16.	" "	Anna.	Peter Bellas.	Elis. Cath.	Philip Belles, Catharina.
Oct. 16.	" "	Gertrauta.	Jacob Holleberger.	Gertrauta.	
1786. April 7.	" "	Juliana.	Abraham Blum.	Maria.	Peter Blum and Eva his wife.
1786. June 18	July 8.	Catharina.	Christian Henner.	Susanna.	
Oct. 7.	Oct. 7. 1787.	Thankful.	Christoph Srope.	Thankful.	Ferdinand Srope, Dorothea, his w.

BIRTH.	BAPTISM.	CHILD.	FATHER.	MOTHER.	WITNESSES.
Dec. 28.		John.	Christoph Srope.	Thankful.	
1787. July 24.	Oct. 7.	Henrich.	Johannes Leonhard.	Elisabeth.	Joh. Leonard and w.
Jan. 28.	Oct. 8.	David.	Peter Heller.	Anna.	Johannes Shoemaker, Agnes, his w.
Aug. 10.	" "	Elisabetha.	Adam Leonard.	Elisabetha.	
Aug. 30.	Oct. 7.	Anna.	Martin Jordan.	Eva.	Jacob Jung, Anna Blumin.
Aug. 31.	Mch 8.	Henrich.	Joseph Slatter.	Margaretha.	Peter Blum, Feronica Young.
1787. Jan. 10.	April 25.	Maria.	Charles Horn.	Elisabeth.	
1786. Aug. 31.	" "	Catharina.	Joh. Peter Honner.	Catharina.	
1787. Jan. 27.	May 22.	Cornelius.	Adam Waganer.	A. Maria.	Philip Shlaut, jun., M. Cath Honerin.
1787. Mch 5.	June 13.	Permile.	James Mettler.	Elisabeth.	
May 29.	July 5.	Joh. William.	Jacob Bunn.	M. Elisabeth.	
May 25.	" "	Elisabetha.	Friedrich Abgert.	Elisabetha.	Anna Allbach.
July 7.	Aug. 1.	Joseph.	Jacob Jung.	Maria.	
			1787		
Aug. 21.	Sep. 5.	Anna.	Herbert Blum.	A. Maria.	Abraham Jung, Feronicam, his w.
Aug. 5.	Nov. 7.	Joh. Herbert.	Henrich Weingarten.	Eva.	Herbert Shmiedt and w.
April 28.	Dec. 5.	Abigail.	Peter Bellis.	Else.	
1785. May 9.	" "	John.	Jacob Wicoff.	Susanna.	
1787. Oct. 27.	Dec. 5.	Daniel.	Jacob Wicoff.	Susanna.	
Sept. 26.	" "	Jacob.	Adam Jung.	Margaretha.	Jacob Yung, Cath. Lanz.
1788. Jan. 12.	Apr. 2.	Abraham.	Paul Jungs.	Elisabetha.	Abraham Jung, Eva Blumin.
Jan. 31.		Andreas.	Johannes Sein.	Phebe.	Susanna Hoff.
1783. Feb. 3.	1783.	Jacob.	Paul Jung.	Elisabetha.	Jacob Andres (?), A. Magdalena, Firschbach.
			1788		
1787. Dec. 4.	May 1.	Johannes.	Phillip Shlaut.	Elisabetha.	
Dec. 6.	" "	Johannes.	Peter Shmiedt.	Eva.	Johannes Shlaut, Elisabetha Apgar.
1788. Mch 29.	June 4.	John.	Jacob Badein.	Maria.	
Feb. 28.	" "	Johannes.	Joseph Slatter.	M. Margretha.	John Blum, Anna Blum.
April 24.	July 2.	Frederick.	Jacob Kratzly.	A. Margaretha.	Fred Bickel and w.
Jan. 4.	Aug. 6.	Elisabetha.	Abraham Blum.	Maria.	Balthasar Bickel, Elisabeth Bickel.
July 28.	Oct. 1.	Christian.	Charles Horne.	A. Maria.	
July 17.	" "	Petrus.	Henrich Kass.	Dina.	Peter Blum, jun., Maria, his w.
June 30.	Nov. 9.	Elisabetha.	Peter Heller.	Anna.	Jacob Jung, Elis. Leonard.
			1789		
1789. Feb. 23.	Apr. 22.	Abraham.	James Metler.	Anna.	
1789. Mch 3.	Apr. 22.	Maria.	Herbert Bluhm.	A. Maria.	Peter Bluhm, A. Maria.
Mch. 12.	Aug. 26.	Anna.	Adam Jung.	A. Margretha.	Peter Shmidt, Anna Jungin.
May 1.	" "	Philip.	Phillip Bellas.	Maria.	

May 16.	Aug. 26.	Herbert.	Johannes Hener.	Cath.	
“ “	“ “	Susanna.	“ “	“	
July 20.	“ “	Susanna.	Jacob Jung.	Maria.	
1772. Jan. 25.	July 9.	Peter.	Peter Swick.	Anna.	
1769. Nov. 25.	“ “	Anna.	“ “	“	
1758. Mch. 13.	“ “	Rebecca.	Christ. Dianstmann	Rebecca.	George Servas, Anna Maria.
1778. April 21.	“ “	Peter.	“ “	“	Peter Dunstmann and wife.
1782. July 17.	“ “	Catharina.	“ “	“	“ “
1784. April 2.	“ “	Magdalena.	“ “	“	“ “
1789. Aug. 16.	Nov. 11.	Adam.	Adam Leonhard.	Elisabeth.	
			1790		
1790. Jan. 10.	Mch 10.	Anna Maria.	Johannes Edel (?).	Elisabetha.	Philip Bellas, A. Maria, his wife.
1789. Nov. 15.	“ “	Benjamin.	Georg Horn.	Maria.	
Oct. 16.	“ “	Sarah.	Frederick Apgert.	Elisabetha.	
1789. May 27.	May 13.	Phillipus.	Adam Waggener.	A. Maria.	Philip Schlaudt, Eva Blum.
1790. April 4.	June 3.	Maria.	Philip Schlaudt.	Elisabetha.	
1790. April 26.	“ “	William.	Paul Jung.	Elisabetha.	Sarah Jung.
1790. May 6.	June 3.	Elisabetha.	Joseph Slatter.	Marg.	Fred Apgar and w.
1790. July 20.	Sept. 15.	Johannes.	Jacob Kratzly.	A. Margr.	Joh. Edel and Elis his w.
1790. July 9.	“ “	Maria.	Lucas Covert.	Cornelia.	
July 31.	“ “	Johannes.	Adam Jung.	Margretha.	Joh. Peter Lantz, Elis Jung.
Sept. 1.	Dec. 15.	Eva.	Abraham Blum.	Maria.	Peter Blum and Eva his w.
Oct. 12.	Dec. 16.	Matheus.	George Broehtly.	Catharine.	Matheis Brachtly, Barbara, his w.
July 6.	Aug. 6.	Johannes.	Nicolas Bickle.	Elisabetha.	
			1791		
1791. Jan. 8.	Apr. 13.	Reny (?).	James Mettler.	Elisabetha.	
Mch 10.	“ “	Rebecca.	Charles Horn.	Maria.	
1781. Feb. 19.	“ “	George.	Peter Bellas.	Else.	
1791. Feb. 16.	“ “	Peter.	David Stein.	Margretha.	Peter Bloom, Maria, his w.
1790. Sept. 3.	May 3.	Ruben.	Johan Genckler.	Anna.	
	1791.	Elisabeth.	wife of Joh. Jos. Bruch.		
1791. July 20.	July 24.	Jacob.	Herbert Blum.	A. Maria.	Jacob Blum, A. Maria Epgar.
July 4.	Aug. 21.	Getrud.	Abraham Jung.	Elisabeth.	Peter Jung and Elisabeth.
1790. Aug. 23.	“ “	Maria.	Schimhiders.	Margaretha.	Herbert Schmid and Gertraud.
1791. July 28.	Aug. 30.	Fredericus.	Jacob Bedein.	Maria.	Johann Bickel and Barbara.
July 15.	“ “	Fredericus.	Jacob Hertsman.	Maria.	Fredericus Epgar and Elisabeth.
Apr. 21.	“ “	Georgius.	Johannes Hertsman.	Catharina.	
Mch 16.	Sept. 30.	Margratha.	William Kass.	Anna.	
1791. Sept. 21.	Nov. 13.	Johannes.	Henrich Weingart.	Eva.	
Dec. 14.	Dec. 26.	Maria.	Joseph Schlatter.	Margaretha.	Maria Epger.
			1792		
1791. Dec. 28.	Feb. 8.	Samuel.	Johannes Sinkler.	Anna.	
1792. Jan 29.	May 6.	Willhelm.	Frederick Epgar.	Elisabeth.	Wilhelm Schmid, Maria Blum.

Birth.	Baptism.	Child.	Father.	Mother.	Witnesses.
July 8.	Oct. 7.	Anna Barbara.	Nicolaus Bikel.	Rebecca.	Balthasar Bikel and w.
July 31.	" "	Anna.	Willhelm Metler.	Catharina.	
Sep. 20.	Oct. 28.	David.	Jacob Jung.	Maria.	
June 28.	" "	Wielhelm.	Philip Schlaut.	Elisabeth.	
1792. Aug. 12.	May 10.	Joseph.	Peter Bellas.	Elsy.	
1793. Jan. 31.	1793.	Isaac.	Paul Jung.	Elisabetha.	
Jan. 7.	Apr. 21.	Rhody.	James Metler.	Elisabetha.	
1791. Aug. 28.	June 19. 1793.	Catharina.	Adam Leonard.	Elisabetha.	
1792. Dec. 7.	June 19. 1793.	Catharina.	Abraham Jung.	Elisabetha.	
1790. Jan. 21.	" " "	Rebecca.	John Drake.	A. Juliana Henn.	
1792. July 3.	Sept. 2.	Margretha.	Andreas Flickinger.	Catharina.	Jacob Bunn, Maria Elisabetha, his wife.
1793. Oct. 3.	Dec. 8. 1793.	Hanna.	Johannes Edel.	Elisabetha.	
July 5.	" " "	Rosina.	William Schuler.	Esther.	Rosina Bunn.
1794. Jan. 18.	Nov. 23.	Maria.	Christopher Srope.	Thankful.	
Apr. 4.	" " 1794.	Sarah.	Peter Schmied.	Eva.	Johannes Blum, Sarah Jungin.
1794. June 9.	Nov. 23.	Jacob.	Frederick Apgar.	Elisabetha.	Jacob Blum, Maria Elis.
1794. Oct. 10.	Nov. 23. 1794.	Elisabetha.	John Blum.	Maria.	Frederick Apgar and wife.
Feb. 11	Mch 19. 1794.	Elisabetha.	Jacob Bodine.	Maria.	
		Daniel.	Bellas.		
		Catherine.	"		
		Elisabetha.	"		
			17	95	
1795. Mch 11.	Aug. 30. 1795.	Frederick.	Jacob Blum.	Catharina.	Frederick Apgar, Elisabetha, his w.
May 9.	" " "	Sarah.	Adam Young.	Margaretha.	
Dec. 13.	" " "	Cornelius.	Philip Slaut.	Elisabetha.	
Feb. 7.	" " "	Charity.	James Metler.	Elisabetha.	
1794. Sept. 28.	" " "	Elisabetha.	John Sinclear.	Anna.	
Aug. 10.	" " "	Elisabetha.	Richard Gano.	Margaretha.	
1793. Dec. 9.	" " "	Hanna.	Conrad Eyler.	Margaretha.	
1795. June 8.	" " "	Abraham.	"	"	
Feb. 26.	" " "	Elijah.	John Allen.	Ronchy.	
1794. July 16.	" " "	John.	Daniel Brinck.	Mary.	
			17	95	
			Baptized a me	J. Wack.	
1793. Aug. 23.	Oct.	John.	John Heitman.	Catharina.	
Nov. 5.		James.	"	"	
1777. Nov. 26.	Nov. 29.	Isaac Robis.	after confession	of faith.	
1795. Dec. 10.	Dec. 20.	Godfrey.	John Blum.	Mary.	Godfrey Case, Sarah Young.
Oct. 20.	" " "	Margareth.	Paul Kelse.	Anna.	

1796. May 19.	July 17. 1796.	Sarah.	Minnie Euliek.	Mary.	
1796. May 11.	July 17.	Susanna.	James Hoff.	Sarah.	
May 1.	" "	Nancy.	Isaac Duckworth.	Mary.	
1795. Dec. 22.	June 26. 1796.	Rebecca.	Christopher Srop.	Thankful.	
1795. July 30.	" "	Elisabeth.	John Bellos.	Anna.	
1795. June 9.	Oct. 2.	Elisabeth.	Jacob Hitesman.	Mary.	
1796. May 29.	Nov. 10.	Elisabeth.	John Albach.	Sarah.	
1795. Jan. 1.	Oct. 2.	Elisabeth.	William Schieler.	Hester.	
1796. Sep. 3.	Nov. 13.	Isaac.	Jacob (?) Blum.	Catharine.	Fred Apgard, Elizabeth, his w.
1795. Nov. 6.	" "	Isaac.	Peter Bellis.	Elsa.	" " "
1796. Oct. 8.	" "	Mary.	Adam Young.	Margareth.	
Sept. 4.	" "	Sarah.	Jacob Bodine.	Mary.	
Sept. 25.	" "	Elisabeth.	Henry Stout.	Mary.	
Sept. 22.	" "	Mary Barnes.	Nics. Piekle.	Betsey.	
May 1.	Dec. 11.	Charity.	George Lampen.	Elisabeth.	Godfrey Case, Charity Wines.
Age 33	Feb. 5. 1797.	John Hartmann.	after confession	of faith.	
1784. Feb. 8.	" "	Elisabeth.	John Hartman.	Mary.	
1786. July 11.	" "	Peter.	"	"	
1789. Feb. 5.	" "	Christopher.	"	"	
1792. Feb. 15.	" "	John.	"	"	
1795. Oct. 17.	" "	Mary.	"	"	
1797. Jan. 22.	May 7.	Hanah.	William Metler.	Catharine.	
1796. Oct. 23.	" "	Charles.	Abraham Gulick.	and wife.	
1796. Nov. 10.	" "	Elisabeth.	Paul Slaut.	Sophia.	
1797. April 19.	May 28.	Barbara.	Jacob Cratsly.	Margaret.	
Feb. 18.	" "	Rachel.	Moses Allen.	Margaret.	
Mch 17.	" "	Christopher.	William Hiner.	Lydia.	
1797. Mch. 9.	July 9.	Anna.	John Sinelair.	Anna.	
April 6.	" "	Susanna.	James Mettler.	Elisabeth.	
Mch 22.	July 29.	Mathias.	Fred Pickle.	Catharine.	
April 28.	Aug. 20. 1897.	Paul.	Fred Abgard.	Elisabeth.	
1796. Oct. 10.	" "	Isaac.	Peter Smith.	Eva.	
1797. July 28.	Sept 18.	Anthony.	John Hoff.	Rachel.	
Oct. 7.	Jan. 6. 1798.	Theodosia.	Abraham Gulicks.	Prisilla (?).	
Nov. 28.	" "	Mary.	Wm. Albach.	Hanah.	
1787. Sept. 7.	Dec. 17. 1797.	Samuel.	John Bellis.	Elisabeth.	
1789. May 9.	" "	Rebecca.	"	"	
1790. Dec. 7.	" "	Phebe.	"	"	
1792. Oct. 22.	" "	Urial.	"	"	
1794. Dec. 28.	" "	Isaac.	"	"	
1797. Mch 7.	" "	John.	"	"	
1797. Sept. 25.	April 29. 1798.	Elisabeth.	Philip Stout.	Elisabeth.	
Feb. 6.	Mch 19.	Peter.	Peter Case.	Sarah Young.	
Nov. 28.	May 27.	Joseph.	Christopher Shroop.	Thankful.	
	" "	Mary.	" "	"	
	" "	Henry.	" "	"	

BIRTH.	BAPTISM.	CHILD.	FATHER.	MOTHER.	WITNESSES.
1797. Oct. 9.	June 27. 1798.	Margreth.	William Wagner.	Anna.	Wm. Wagner, Margretha Case.
Nov. 8.	July 8.	Mary.	John Allen.	Ranch.	
1790. Apr. 25.	July 8.	Henry.	Dan'l Brink.	Polly.	
1797. Mch 25.	July 22.	Hanah.	Valentine Holtzheiser.	Mary.	
1798. Oct. 2.	Jan. 20.	Jonathan.	Nicholas Pickle.	Betsey.	
1797. Nov. 27.	Mch 3.	Mary.	Herbert Bellis.	and wife.	
1798. Feb. 16.	Feb. 19. 1799.	Jacob.	Dan'l Curtis.	Rosina.	
1793. July 6.	Feb. 28. 1799.	William.	Jacob Vanderbilt.	Phoebe.	
1795. Nov. 19.	" "	Anna.	"	"	
1797. Feb. 11.	" "	Fanny.	"	"	
1798. Sept. 11.	" "	Eva.	Herbert Bellis.	Charity.	
June 6.	Mch 3.	Anna.	John Bodein.	Mary.	
July 14.		William.	Jacob Bodine.	and wife.	
1797. Nov. 5.	Feb. 16. 1800.	Anny.	Conrad Egler.	Margret.	
1797. Nov. 5.	" "	John.	"	"	
1798. Sept. 14.	Sept. 1. 1799.	Catharine.	Henry Stout.	Mary.	
1786. Nov. 12.	Mch 3. 1800.	John.	Aaron VanSyckle.	Caty.	
1788. Aug. 16.	" "	Elijah.	"	"	
1790. Nov. 2.	" "	Daniel.	"	"	
1793. May 26.	" "	Aaron.	"	"	
1796. April 29.	" "	Mase.	"	"	
1798. Oct. 22.	" "	William.	"	"	
1799. July 10.	July 7.	John.	William Wagner.	Anna.	
1797. Apr. 20.	Nov. 3.	Sarah.	John Heitsmah.	Caty.	
1798. Sept. 15.	" "	Mary.	"	"	
1799. Dec. 5.	" "	William.	"	"	
Aug. 2.	" "	John.	William Vanderbilt.	Elisabeth.	
1800. Feb. 2.	" "	Mathias.	John Bunn.	Elisabeth.	
1799. June 2.	" "	Mary.	John Sinclair.	Anna.	
	" "	William.	Jonathan Metler.	Anna.	
1800. Aug. 9.	Dec. 15.	Abraham.	Jacob Stein.	Catharine.	
1800. Oct. 19.	Dec. 15.	William.	Herbert Bellis.	Charity.	
1800. Oct.	Dec. 14.	Henry.	Fred'k Jordan.	Catharine.	
1798. Oct. 19.	Feb. 15. 1799.	Catharine.	Peter Henn.	Sary.	
1800. Aug. 22.	Dec. 17. 1800.	David.	"	"	
April 6.	" "	Fardenant.	Christopher Scrope.	Thankful.	
Feb. 7.	Apr. 26. 1801.	Wm. Carter.	William Allpach.	Hanah.	
June 18.	" "	Elijah.	Benj. Wright.	Piety.	
	Apr. 27. 1801.	Elisabeth.	wife Mathias Allpach.		
1797. Jan. 14.	" "	William.	Mathis Allpach.	Elisabeth.	
1800. May 16.	" "	John.	" "	"	

BIRTH.	BAPTISM.	CHILD.	FATHER.	MOTHER.	WITNESSES.
1801. April 14.	June 7. 1801.	Elisabeth.	Jacob Blum.	Catherine.	
1801. Aug. 3.	" "	Agnes.	Henry Stout.	Mary.	
Feb. 14.	Aug. 30. 1801.	Sarah.	John Blum.	Mary.	
1800. Oct. 1.	May 3.	Hanah.	John Allen.	Raney.	
1801. Feb. 4.	" "	William.	James Egman.	Sally.	
Mch. 4.	" "	Elisa.	Peter Smith.	Hanah.	
		Sally.	Garret Covenhoven.		
		William.	" "		
		Polly.	" "		
		Hanah.	" "		
		David.	" "		
		Peggy.	" "		
		Merey (or Merey)	" "		
		Aaron.	" "		
1801. Feb. 28.	Oct. 18. 1801.	John.	William Case.	Anna.	
July 15.	" "	Peter.	William Wagner.	Anna.	
	" "	Hanah.	John Brink.	Sally.	
May 20.	Jan. 24. 1802.	Henry.	Philip Case.	Elisabeth.	
1800. July 30.	Mch. 29.	Anna.	John Bellis.	Anna.	

Guaranty Trust Company of New York
140 Broadway, New York

Problems of Federal Taxation

ADDRESS

By James Rattray, of the Guaranty Trust Company of New York, before the Joint Convention of the Pennsylvania and Atlantic Seaboard, and the New York State Retail Hardware Associations, New York City, February 15, 1918

WAR finance has ever been a problem of the greatest magnitude, and in this war it is greater than ever before. We must win the war, but we can do so only through the coördination of our resources, and by the application of correct principles of finance.

Leading financiers and economists have devoted much time and thought to the problems involved. Arguments have been advanced for meeting the cost of the war solely by bond issues, but history has taught us the futility of issuing Government bonds without providing adequate revenue from taxation for debt service and amortization of the principal.

If we knew that this war would soon be ended, this question of financing might not be a very serious one. Prudence, however, requires that we prepare for a long war: and in adopting a policy of financing by bond issues supplemented by sufficient revenue from taxation for the necessary charges, the Government has decided on a course of action that appears to be not only just, but economically sound.

Our Taxation Not Excessive

In furtherance of this policy, the recently enacted War Revenue Act provides for additional revenue from income taxes, excess profits taxes, and other taxes, of approximately $3,000,000,000 out of our estimated annual expenditure for war purposes of about $10,000,000,000. If the war should last for only three years, it would require about fifteen years of that additional taxation to meet interest charges and provide for repayment of the bonds issued. Of course the maturities of the Liberty Loan bonds that have been issued are longer than fifteen years, but some of the revenue from taxation will be required for current expenses, and therefore there appear to be good reasons for believing that the taxation provided for is not excessive.

That war taxation imposes a heavy burden on the people, and especially on those who derive no direct financial benefit from Government expenditures, cannot be questioned. But even the heaviest burden of taxation is light in comparison with the sacrifices that our men in the trenches are making, and aside from our duty to them, it will be cheaper in dollars and cents to win the war than to lose it.

For the successful prosecution of the war the estimated amount to be derived from taxation must be raised. It is, therefore, as much our patriotic duty to pay our full shares of taxes as it is to subscribe to Liberty Loan Bonds.

Those who are in the trenches are not only doing "their bit" but are also doing "our bit." They are devoting all their time and risking their lives to make the world safe for democracy, whereas we at home are giving only a very small part of our productive effort to help win the war, and in most instances without risk of any kind. For example, an individual receiving $3,000 per annum will pay a tax of $20. if he is married, or in other words he will work for the Government for two days in the year without payment. One receiving $10,000 per annum would pay taxes of $355, or would give the equivalent of about ten days' work to the Government. As the income increases, the percentage taken by the Government also increases, but at no time does the sacrifice compare with what is required from the men in our armies in the field. When we are inclined to feel that taxation imposes hardships upon us, let us remember the cause in which these taxes are levied, and the fact that no matter how great our financial contribution to the cause, it is small compared with the sacrifices that others are making.

Errors in Making Returns

Owing to the complexities of the Revenue Acts, many errors are made each year in the tax returns that are filed. In some cases too much income is returned for taxation, and in others not enough. But the Government neither expects nor desires anyone to pay more than what is justly due; for if all income subject to taxation is reported, and full advantage taken of all allowable deductions, exemptions and credits, the revenue to the Government from this source should be all that is expected. Errors in making returns, even if the error is in favor of the Government, cause serious inconvenience to the taxpayer, for they usually result in an examination of his records by an agent of the Treasury Department for the purpose of ascertaining the correct amount due.

Theoretically, it should be possible for anyone to fill out the prescribed forms after reading the accompanying instructions, but in practice it can't be done. In a general way these instructions are explicit, but it is impossible to recite all the Treasury Decisions that have been given from time to time, to interpret and clarify obscure points in the law. The decisions that have been issued since the original Income Tax Law was enacted in 1913 are voluminous, and, every day, new questions arise that must of necessity be submitted to the Treasury Department; for its decisions have the force and effect of law unless reversed by the courts. A brief analysis of the Revenue Acts now in effect will give some idea of the difficulties to be encountered in complying exactly with their provisions.

Who and What are Taxed

To determine who is subject to the taxes that are now in effect and to what extent, it must be borne in mind that the War Revenue Act of October 3, 1917, provided only for additional taxes, and that the provisions of the Act of September 8, 1916, as amended, and some of the provisions of the Act of March 3, 1917, are still in operation. These Acts impose taxes on individuals, partnerships, corporations, joint stock companies and associations, resident and non-resident, domestic and foreign, and are assessed against annual net income and in many other ways. For example, there are taxes on beverages, tobacco and cigars; excise taxes on motor boats, automobiles, etc., taxes on insurance policies, admissions to places of amusement and on dues in social clubs. Then we have taxes on freight, express and passenger transportation; and, probably the most far reaching in its effect, the tax on postal rates.

Under the War Revenue Act, inheritance taxes have been increased, and various stamp taxes have been imposed which are practically a re-enactment of the taxes imposed under the Emergency Revenue Act of October 22, 1914. The Schedule of Stamp Taxes became effective on December 1, 1917, and is more susceptible of exact interpretation than any other portion of the Act, but numerous questions requiring Treasury decisions have already arisen in connection with it. In the aggregate the revenue to the Government from the sources enumerated above, will be considerable, but a greater amount will be derived from income taxes and excess profits taxes.

Individuals are subject to the normal tax and surtax under the Acts of September 8, 1916, and October 3, 1917. These taxes are imposed on the net income after deducting certain specified deductions, exemptions and credits, but although the laws are clear on the method of computing net taxable income, it is not always easy to determine whether or not receipts of certain kinds, are income within the meaning of the Act, or what expenditures and losses are allowable deductions. For example: certain classes of income, such as property acquired by gift, and interest upon State and Municipal Bonds, are exempt from all taxation. Interest on United States Government bonds, issued prior to September 1, 1917, is also exempt; but interest on Liberty Loan 4% bonds is subject to surtaxes and excess profits taxes, except that the income from a principal amount of $5,000 is exempt from all taxation. It is frequently difficult to determine what is and what is not deductible, for the charging off of certain items on one's books does not necessarily constitute them deductions from net income for taxation purposes.

Exemptions Allowed

Under the Act of September 8, 1916, personal exemptions of $3,000 for single persons and $4,000 for married persons or heads of families are allowed, and an additional exemption of $200 for each dependent child under 18 years of age; for the purpose of the additional 2% normal tax imposed by the Act of October 3, 1917, the first two exemptions are reduced to $1,000 and $2,000 respectively, but the exemption for dependent children remains the same for both taxes.

For the purpose of the normal tax, a credit is allowed for dividends of domestic corporations, taxable for income tax, but no credit is allowed for dividends of foreign corporations. Credit is also allowed for tax that has been withheld at the source, and this is rather confusing as the War Revenue Act provides that any amount of tax heretofore withheld shall, with one exception, be refunded to citizens and residents of the United States, and the entire tax shall be collected from the individual.

The exceptions referred to is in the case of bonds containing a covenant that the debtor corporations will pay all, or a portion of the Federal Income Tax, and withholding is still in affect against the owners of bonds of this class. This is apparently an anomaly, but in practice there is no actual withholding as against the owner of the bonds, who receives payment of his interest in full and has the tax paid for him by the debtor corporation as heretofore.

Partnerships, as such, are not subject to the provisions of the Income Tax Laws, but they are subject to Excess Profits Tax. Income Tax returns must be made by each member of a partnership as an individual, and he is entitled to a credit for his proportionate share of excess profits tax paid by the partnership, and interest on tax-exempt securities and dividends on corporate stock owned by it.

Corporation Taxes

Under the Revenue Acts now in effect, corporations are subject to various taxes and a number of other duties are imposed on them. The Act of September 8, 1916, subjected munition manufacturers to a tax of 12½% on their entire net income for the year, without any specific deductions; but under the War Revenue Act, that tax was reduced to 10%, and provision was made whereby it expired by limitation on January 1, 1918. For the purpose of the Capital Stock Tax of 50 cents per $1,000 imposed by the Act of September 8, 1916, on the fair market value of the capital stock of all corporations, except exempt corporations, as defined in the Act, there is allowed a specific exemption of $99,000, and also a credit for any amount paid as munitions tax.

The Act of October 3, 1917, increased the income tax on corporations from 2% to 6% of the net income, but for the additional tax of 4%, there is allowed a credit for dividends on stocks of domestic corporations owned, and for the total tax of 6%, credit for excess profits tax assessed against it for the calendar year. In addition to this 6% income tax, corporations are also subject to a tax of 10% on surplus earnings for the calendar year, which are not employed in the business, nor retained for employment in the reasonable requirements of the business, and which remain undistributed six months after the close of the year. If this surplus, however, is invested in obligations of the United States, issued after September 1, 1917, it is not subject to tax. Corporations are entitled to the deductions and credits provided for in the law, and a corporation's greatest difficulty in making its return usually arises in determining what are and what are not allowable deductions.

The Commissioner of Internal Revenue may require corporations to make a return of all dividends paid by them, giving details of the years in which the distributed earnings were accumulated and the amount applicable to each. This is presumably for the purpose of checking up individual returns, as the law as amended now provides that dividends shall be returned as income for the year in which they are received, but shall be taxable at the rates for the years in which they were earned. Returns may also be required from brokers giving details of profits and losses made by their customers. In addition to these returns, everyone distributing fixed or determinable gains, profits or income of $800 per annum or over, must give the Commissioner of Internal Revenue particulars of the amounts paid and the names and addresses of the recipients.

Computing Income Taxes

In referring to income taxes it has been mentioned that in computing them a credit is allowed for excess profits tax assessed for the same calendar year. This of course means that the excess profits tax must be calculated first, and it is only within the last few days that the Treasury Department regulations interpreting the excess profits tax law have been available.

The majority of people are willing to pay their share of taxation, but the excess profits tax law has been so ambiguous that it has been impossible to determine how an individual, partnership or corporation would be affected by it. That chaotic condition exists no longer for definite rules for computing excess profits tax have now been laid down, and in formulating these rules the Advisory Committee has given a very broad interpretation of doubtful sections of the law.

Some time ago the method of computing the tax under Section 201, was announced, and that ruling permitted the application of the allowable deduction according to the intent, but certainly not according to the literal meaning of the law.

Construing Definitions

It was nothing but fair that the whole amount of the deduction should be allowed, and the same spirit of fairness has been shown in interpreting "Invested Capital" and "Nominal Capital." Under a literal interpretation of Invested Capital some concerns would have had to pay taxes out of all proportion to their earnings on account of the restrictions in the law as to what may be included as "Invested Capital." In the rules laid down by the Treasury Department however, "Invested Capital" means capital, surplus and undivided profits, and the regulations even go further and permit the inclusion in "Invested Capital" of amounts that have formerly been charged off on the books, but not taken as deductions in previous returns for income tax purposes.

Nominal Capital has also been construed liberally. It is not the mere size of the capital that will class it as nominal, but the purpose for which it is used. In general where the earnings are primarily derived from the activities of the owners, and the capital is required principally through delays in collecting amounts due or for the purpose of meeting current expenses or providing office equipment, it will be considered nominal.

Another unexpected ruling relates to the specific deduction of $6,000 in the case of individuals and partnerships. Individuals engaged in business having invested capital are allowed a specific deduction of $6,000 in addition to the deduction of a percentage of their capital, and besides they may take another deduction of $6,000 for the 8% tax assessed against any salaries that they may allow themselves from the business, under the ruling authorizing such salary payments. The same is also true in the case of partnerships.

The regulations provide that each corporation and partnership must submit a balance sheet as of the first day of the taxable year, and the close of the taxable year. This will necessitate much better accounting systems than have generally been in use, and in that respect at least, taxation will have done something that will be of decided advantage in our industrial and financial relations with each other.

"Over the Top" in Business and Finance

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Address by
Francis H. Sisson, Vice President
Guaranty Trust Company of New York
at the
Twenty-seventh Annual Convention
Illinois Bankers Association
Quincy, Illinois, September 19, 1917

Guaranty Trust Company of New York
140 Broadway, New York

"Over the Top" in Business and Finance

ADDRESS BY

Francis H. Sisson, Vice President, Guaranty Trust Company of New York, at the 27th Annual Convention of the Illinois Bankers Association, Quincy, Illinois, September 19, 1917.

THE United States has come out of the trenches of neutrality and gone "over the top" into active war. The United States has also gone "over the top" in business and finance. The days of peaceful profit and smug satisfaction are gone. So, also, are the days of provincialism and narrow insularity. We are in the world war; we are a part of the world struggle; and whether we will it or not we are concerned in all that means the political and economic future of the nations of the world as well as our own.

Into this hurly-burly of war, into the diplomatic mazes and economic tangles of international interests, we have been drawn by the stern logic of events, compelled to take our place and do our part in order that the world may be made safe for democracy and for the institutions which are vital to our own national life and to the peace and prosperity of our people.

As we march across the "no man's land" of preparation, before we plunge into the enemy's trenches, we may possibly be better guided if we pause a moment to view our position and get our bearings for the next charge.

I recall a line from one of the famous old hymns taught me in my youth in that church-going Illinois town of Galesburg, whose opening appeal was, "Watchman, tell us of the night; what its signs of promise are." So perhaps we can with profit today stop for a moment and seek from our watchers on the outer walls some of the signs of promise, and review some of the accomplished facts that have accompanied our first rush "over the top."

Economic Changes

The effects of the tremendous social, economic, and political changes wrought by war cannot but afford interesting study, and our thoughts are quickened daily to the import of it all. We are beginning to grasp the great significance of the fact that perhaps an important duty of the hour is not only to make the world safe for democracy, but to make democracy safe for the world; to develop our latent resources of spirit and matter, to the fullest possible degree and with the highest possible efficiency, that they may be able to render the greatest possible service in meeting the crises and the opportunities that are before us.

Perhaps the greatest lesson we are learning from our excursion "over the top" is the need of national unity—the absolute necessity for sinking sectional and class feeling in a common hope and effort to serve a common purpose. If we are to meet, with our fullest power, both our enemies from without and our enemies from within, there must be no North and no South, no East and no West, no classes and no masses, but in unity of feeling and community of interest we must move on as one people to our great common task. This war is not a sectional war; it is not a Wall Street war nor a Washington war—it is your war and my war, a war for humanity, and, more than anything else, a war for the ideals upon which this country was founded and upon which its future prosperity depends. In the councils of finance and of government, all sections of the country are represented and their interests weighed. That they may be weighed without fear or favor or prejudice should be the earnest prayer of every patriot.

Government and Business

Another marked step in progress toward the ideal of unity is in the closer union we find today between government and business. Too often have their interests been placed in conflict; too often has the coöperation essential to the success of both been denied. Nothing could contribute more to the development of our resources at home and of our commerce abroad than the sympathetic coöperation of government and business in mutual furtherance of national progress. A broader vision and a greater ability in government, more unselfishness and foresight in business, are absolutely necessary if we are to meet the burdens of today or realize the possibilities of tomorrow.

In many instances the war has shown us how far afield from sound economics some of our governmental policies have led us. For years we have energetically tried by legislation to prevent coöperation in business. Restrictive state and federal laws in bewildering variety have sought to compel an uneconomic condition which the necessities of war reveal in its true light, and every effort of our authorities is now being made to establish, with law or without it, a sound, economic state of coöperation for which the leaders in business and finance have for years pleaded in vain.

Only yesterday the word "pooling" was anathema; today we are pooling food and fuel and ore and oil and transportation, and glorying in the efficiencies and economies effected thereby. Restrictive laws and regulations are ignored, and under the sanction of government, private business is not only permitted but urged to lend its efforts toward effective combinations in the public interest.

Our railroads, under the paternal aegis of the government, are demonstrating in marked degree the efficiency of combination in transportation. With only a 3% increase in equipment, they have shown a 26% increase in transportation service, simply through being permitted, to operate their properties—by agreement among themselves—on a national instead of on a sectional or local basis. Here is a vision of what we may hope for when the railroads may be permanently freed from the thousands of petty cords of local interest which have bound this modern Gulliver, and the instruments of interstate commerce be permitted to serve the needs of interstate commerce, under the direction of the federal body which represents us all.

For years our business men of vision have insisted upon the necessity of developing our merchant marine through ship subsidies and fair regulation, in order that the industrial and commercial interests of this country should find their proper place in the markets of the world. Only the exigencies of war could open the eyes of our governing authorities to the wisdom of this position, but now we find ship subsidies freely granted and every effort being made to give the American flag its place upon the high seas and to open the ocean highways to our great foreign trade.

The natural companion of the American merchantman in foreign lands is the branch of the American bank, and slowly we are beginning to reach out to take our place in the world of finance as we are in the world of commerce. This place cannot be achieved without the fullest coöperation of intelligent and sympathetic government with progressive business.

The Nation's Business

Today the nation's most important business is war. To that task we must address our best efforts. The mobilization of our economic resources is no less important than the conscription of our army, for the army is dependent upon the social and industrial organization of the country.

When the United States joined the Allies and pooled its immense resources with theirs, America's problem became twofold: it was called upon to put at the disposal of its Allies all effective power possible, and, at the same time, to preserve a domestic prosperity. The United States must accomplish titanic financing, and produce a sufficient food surplus to maintain the Allied countries at fighting efficiency.

For the successful prosecution of the war it has been found absolutely imperative to convert the United States into a gigantic corporation, whose business is conducted by a board of directors comprising several committees such as the Cabinet, the Federal Reserve Board, the Export Council, the War Industries' Board, the Food Administration, and the Federal Trade Commission. This is a radical readjustment of our administrative machinery, and creates an anomalous situation when one considers how recently the popular hue and cry was raised against combinations and corporations generally.

If the various administrators appointed by the President have time for reflection in lighter vein they must be amused by the thought that, had they aspired in pre-war days to the arbitrary power at their disposal now, they would have been sent to jail for the remainder of their lives as malefactors and traitors to the public cause. Today they are acknowledged patriots.

Greater changes are inevitable, not alone in governmental affairs but in our business and finances. This is apparent when we realize that, since the outbreak of the European war, the United States has gradually assumed such dominance in fiscal transactions that today it maintains the world's financial equilibrium.

Finance

But we are merely on the threshold of the great era of expansion lying before us. It is essential, therefore, for bankers throughout the country to appreciate that America is today the greatest money market the world has ever known; that we have liquidated our indebtedness to Europe and its peoples are heavily in debt to us; that, by the balance of power thus obtained, we are now controlling the exchanges of the world. But it is still more necessary for them to perceive how we can perpetuate that control, and how we can continue to dominate the production, transportation, and finances of the world.

To materialize that brilliant prospect and to be able to take full advantage of it, we must conserve our money to a greater extent than it has ever before been conserved. We must pool our capital, as it were, in the interest of the Government and of our own future.

Merchants and manufacturers in Canada have been asked to limit their demands for loans on the theory that by so doing they will strengthen the financial situation and better enable the banks to extend the necessary support to the government. In war an unavoidable strain is imposed on bank resources, and for that reason the funds of the country must be conserved.

Only such public and private improvements as are absolutely necessary should be encouraged, and financing should not be undertaken unless it is forced by the exigencies of the situation. Postponement to more propitious days should be the rule. It may even seem best to establish a commission to pass on the priority of public financial offerings, just as has been necessary in production and transportation, in order that the Government may be relieved from all possible competition for labor, materials, and money. "Will it help to end the war?" is the question by which every proposition should be measured.

A Mobile Banking System

Our banking system must be made mobile enough to expand with our quickened commercial interests, and bankers must take advantage of its facilities in rediscounting. Our credit resources must be fully developed to meet the greater demands which will be made upon the United States for loans to our Allies. Our currency system offers possibilities which must be used without fear or prejudice.

It is true that nearly all of the money we lend to our Allies will be spent in this country, but we should remember that to a large degree the money expended by our Government will flow back into Federal coffers in the form of taxes and proceeds from the recurring sales by the Government of bonds which our people must absorb. So it is of paramount importance to have the Government's financing of the war accomplished with business sense and sound economic reasoning, in order to prevent serious impairment of our industries.

There is no doubt about the willingness of our people to supply money voluntarily, through loans, in far larger amounts than they could ever be compelled to provide through taxation. This popular state of mind has been explained as due to the psychology that "loans have all the manifest advantages which moral suasion has over compulsion, which an appeal has over demand, which the promise of reward has over the threat of a penalty."

This is, to be sure, a war for posterity, and future generations should share in its burdens. Yet it would be sheer folly for us to attempt to finance the war wholly by means of loans. Germany has tried to do it, relying upon indemnities to be exacted from her victims to pay the loans. And Germany, as a consequence, is facing economic disaster.

America's participation in the war has just begun but it is already costing us millions of dollars in excess of our Government's ordinary receipts, and future expenditures will make progressively commensurate demands upon our resources. This enormous financing must be continued not only for the duration of the war but to some extent afterwards. Its very momentum will carry it on after peace comes.

Governmental Regulation

The regulation of international financial operations will remain in the hands of governmental authorities, rather than be left wholly to independent action by bankers on both sides of the ocean. Provision for the regulation and control of the movement of gold to and from the United States has already been made in the President's proclamation of August 27.

The gold reserve of the United States is approximately $3,000,000,000. Before the war it was about $1,900,000,000. The significance of the more than a billion dollars' increase in our gold reserve lies in the fact that there are, in round figures, only eight and a half billions of dollars of gold reserve in the world, that is, coined gold and gold bullion. The world's credit structure rests upon that foundation.

But since our entrance into the war we have exported more gold than we have imported. Recently there have been heavy and steady drains upon our gold reserve, chiefly by Japan and Spain. The trouble is not that we have an unfavorable balance of trade with the countries to which we are sending the metal; it is true that we are buying more from Japan than we are selling her but the situation is quite the opposite with Spain. The explanation lies in the balance of trade against the Allies as a whole.

If the outward movement of gold were permitted to continue indefinitely it might have a decidedly serious effect upon the financial status of this country. To let the gold go abroad unrestrictedly would mean that, while increasing government indebtedness to our own people, we should not be adding to our stock of gold, but, on the contrary, would be decreasing our reserve.

It is probable that the control of gold exports will depress still further the value of the dollar in international exchange, especially in Denmark, Sweden, Norway, Holland, Spain, and Switzerland, where foreign exchange is against American money. But that condition can be only temporary. Sooner or later the American dollar will regain its rightful dominance of neutral exchanges.

To cope successfully with conditions, new in their experience and in the history of the United States, bankers throughout the country must study the financial situation with broadening vision.

International Trade

Not only will it be necessary to have international regulation of finances, but also to some extent, regulation of international merchandising. Otherwise, the fiercest commercial competition the world has ever known will follow close upon the greatest war in history. First of all, the world's supplies of food-stuffs, metals, building materials, and other major necessities will have to be distributed equitably for the reconstruction that will follow the close of the war.

The Allies today are studying prospective industrial conditions after the war. There is full recognition of the need for coöperation when peace is arranged. The interdependence of the Entente Powers and their respective industries has never been more manifest. The Allied governments realize that they must retain supervision of imports and exports. Future commercial relations between the different nations, undoubtedly will be discussed when peace conferences are held, and it is more than probable that the Allies will draw up some broad, general plan to keep inevitable German competition within bounds. To prevent indiscriminate competition, the Allies must conduct their buying on some such lines as they have established during the war.

Meanwhile, the United States must bend every effort to increase its producing capacity, which, although it is greater than ever, is not equal to the maximum world demands now being made on it because much European production is either diverted solely to the requirements of war or is in enforced idleness. Fortunately, American adaptability is swiftly and more or less smoothly adjusting American business to the new situation.

Changes Wrought by War

A fundamental change occurred in our business conditions when this country abandoned neutrality to protect democracy. The question of the ethics of exacting excessive profits out of necessities purchased by the Federal Government was one of the potent factors in bringing about the change. Our new obligations to the Allies naturally forbade exploitation of them. To the credit of leaders of industry, it should be noted in passing that the majority of our producers have patriotically coöperated with the Government in reducing prices to a reasonable basis.

The business man, no less than the soldier, must make sacrifices for the protection of his country. Likewise, it is incumbent upon the government to exercise care in commandeering business men's profits so that individual or corporate incentive and ability may not be lessened.

The American public, too, will have to prepare for a sharp readjustment in values after the war. Prices of material and merchandise will fall. Banks are now forced to lend to their customers a great deal more than in normal times because the value of stocks of merchandise has increased unprecedentedly. When peace comes, the reaction will be marked; a sudden peace might precipitate a violent depression of war-inflated values of merchandise. Manufacturers and merchants who have on hand goods which were produced under fictitious conditions as regards cost of labor and material, and for which there may be little demand, even if sold at a loss, may suffer.

The Use of Acceptances

The more general use of trade acceptances will tend to safeguard the business future by materially developing the credit resources of the country on a sane and safe basis. They will help to check overbuying, eliminate losses from bad and slow collections, simplify bookkeeping, and rate the buyer as a preferred customer. All of these advantages, and many more which trade acceptances possess, obviously will benefit the consumer also. Thus the general adoption of trade acceptances is a national economic necessity.

One of the salutary results that will grow out of the extended use of acceptances will be the establishing of a closer relationship between the manufacturer and merchant and the banker. The selling of products abroad necessitates the granting of some form of credit. In many instances, the manufacturer or merchant is not himself in a position to give credit, but he can arrange for it with his banker by means of a trade or a bank acceptance—a sound circulating medium of finance that commands a low interest rate. England achieved her preëminence in the financial and commercial world by the use of acceptances. American business and industry must employ the same means to the fullest possible extent if they are to realize their possibilities.

The industrial expansion required of us by the war must be encouraged, for it is necessary to the success of our military operations. President Wilson only recently reminded us that "the battle-line of democracy for America stretches from the fields of Flanders to every house and workshop." So, despite the enormous drafts which the Government is making, and will continue to make upon our financial resources, sufficient funds must be found to develop our industries adequately to meet the demands upon them. That situation will create a steady demand for capital and occasion a gradual rise in money rates.

Problems in Agriculture

Every effort must be expended to develop our agricultural resources. The United States will have to be converted into a veritable granary, for war is as much a matter of food supply as of men, munitions, and money. The world depends upon the United States to save it from famine.

But the assurance of bumper crops generally, and their vast increase in values, present new problems in our financial readjustments. Prices are higher than ever before, and the price-factor is playing a strikingly important role in the financing of this year's harvests. The volume of money which will ultimately be needed for this purpose will be enormous. The figures of normal times afford no criterion for today and cannot be used as a basis for calculation now.

The prevailing high prices for wheat, corn, oats, and rye will result in great prosperity, which will be experienced first in the West but which will eventually spread throughout the entire country, for the price of food is the basic cost of producing almost everything else that humanity consumes.

Another big factor in marketing the crops this year is the difficulty in transportation. Transportation facilities are as essential as money in the movement of grain. Time is the essence of the contract in banking and in transportation.

The railroads have been asked by the Government to provide facilities for the movement of troops and for the transportation of supplies and munitions of war. It will require a great deal of power and rolling stock to move our new armies to their destinations. This extraordinary movement is likely to disorganize, or at least seriously to interfere with, the traffic not only of the railroad systems directly concerned but also of connecting lines. It is inevitably bound to retard and make still more difficult the movement of merchandise and of great commodities that have to be financed from the time they leave the place of production until they reach their points of destination here or abroad.

The marketing of the cotton crop also will be difficult not alone for these reasons but because of the destruction of ocean tonnage. As a consequence of German submarine activities, war risk insurance is higher than ever, thereby adding to the cost of moving cotton. Besides, our present comparatively small merchant fleet is now needed to transport men, foodstuffs, and munitions to Europe. Many of the coastwise steamers which usually carry cotton have either been sold or commandeered by the Government.

Transportation

This problem of transportation facilities, constitutes a most important element not only in the vital matters of crop movement and military operations, but in practically every phase of our life.

The trend of national coöperation is strikingly exemplified in railway readjustments. Through the activities of the Railroads' War Board, the 262,000 miles of railroads in the United States have been operated since April practically as a single system. The shortage in cars has been reduced approximately 75 per cent. During July about 16,000,000 train-miles per year were eliminated. The taking off of unnecessary passenger trains has made available more than one million tons of coal for other purposes. The remarkable increase in the handling of ton-mileage is equivalent to an addition of 35,000 miles to our railroads, or 11,000 miles more than the total of Great Britain and only 3,000 miles less than the mileage of Germany. It has amounted, in other terms, to the adding of 125,000 cars to the rolling stock of the roads.

Perhaps the most satisfactory feature of this great improvement in railroad efficiency is that at least some of it will be permanent, and will lead to further progress toward an ideal of efficiency under some plan of unified regulation and operation by which railroad credit will be protected and the expansion of railroad facilities encouraged.

Labor

Perhaps the greatest economic problem which the United States will have to solve when the war ceases will be that of finding useful work for millions of men, capital to keep them busy, and markets for their products.

The demands of war have created more employment than ever before existed in this country. Wages are higher and there is practically no unemployment. In fact, we are facing a shortage of labor similar to that with which Europe had to contend at the beginning of the war. Yet we must face the day on which millions of men will be released from martial pursuits when the army is demobilized, and millions more will be out of work when the factories engaged in the manufacture of munitions and auxiliary products discharge their hordes. There must be an equitable but radical liquidation and redistribution of such labor.

A new problem is presented in the sex element of the industrial situation. The dearth of men in many important fields of labor is daily necessitating the employment of more women, even in strenuous physical pursuits. It is significant of the rapidly advancing tendency in this direction that the Army and Navy departments have announced that wherever women applicants can take the place of men in the routine work, they will be given preference. Many big manufacturing concerns and mercantile houses are doing likewise. Banks have replaced a large number of their men clerks with women; railroads are employing women in many departments, and munition plants are training women in order gradually to release their men for military service.

More than one million and a half women have undertaken men's tasks in England.

Another important factor in England's labor situation, and one that will bear fruit in post-war days, is the training of the unskilled. Classes for this purpose have been formed in technical schools, and groups of untrained employes have been placed in plants under skilled men. In these two ways the unskilled have been made efficient.

The part, too, which new inventions and labor-saving machinery are to play in future industrial development must be reckoned with. The worldwide reconstruction which will follow the war will be of such a colossal scope as not only to preclude the possibility of over-production but as to tax our capacities.

World Leadership

This should mean world leadership for the United States with its resources of men, materials, and money such as no nation from the beginning of time has experienced. It means an horizon for us as broad as the earth. It imposes upon us, too, the grave responsibility of discharging our duties to mankind with thoroughness and honor. We must rise to the great opportunity, created partly by circumstances but largely by the native ability and initiative of our people. Upon none of us will more of the burden fall than upon the business man and the financier.

The sheer expansion of credit to meet expenditures in excess of either the liquid income or capital resources of all the countries combined in the present conflict will solve the economic problems of the war only temporarily. The permanent solution depends upon increased production.

Astonishing proof of the productive power of the world-at-large is furnished by the fact that war on the scale maintained for more than three years has not caused general privation. True, some of the European countries have suffered great hardships but there has also been a surprising amount of widely diffused prosperity. This demonstrates what a great margin of latent productive power exists in the world.

The United States has not yet fully awakened to her wonderful potentialities, which this war, deplorable as it is, will develop and not destroy.

Some student of ethnology has declared that the racial genius of the Anglo-Saxon is for initiation, of the Teuton for organization, and of the Celt for administration. In this country we have them all combined, and they need but be harnessed together by wise government to make a team of the greatest power. Never before in our history has it been so apparent that America is in reality the "heir of all the ages." Never before has it been more apparent that "we are living, we are dwelling in a grand and awful time, in an age on ages telling; to be living is sublime."

Through the discipline and lessons of war, we should be able to take a far step toward that momentous destiny of which the poet sings, which will mark humanity's farthest progress. These lessons are obvious to us all: thrift in place of waste, simplicity instead of self-indulgence, respect for authority in place of careless anarchy, patriotism instead of localism, breadth instead of narrowness, service instead of selfishness. If these be a part of the harvest of war, whatever be its cost, it will not have been in vain, and it will have paved the way for better days to come. If we can learn that neither money nor power are sufficient things in themselves for men to live for or die for; that, after all, the greatest sense of achievement comes in the triumphs of spirit in a righteous cause, then, indeed, our dead will not have died in vain.

Signs of the Future

But along with these signs of promise, we cannot ignore other signs not so reassuring. The rapid rise of socialistic theories, with their certain menace to individual initiative and national progress, can but cause concern to the thoughtful observer. The failure of our melting pot to assimilate our mixed population and the evident un-Americanism of thousands who have come to our shores to make their homes, are suggestive of grave dangers. The expressed hostility to wealth and the manifest ignorance of its service on the part of public men strike threateningly at conservative institutions. The revealed economic illiteracy of a large proportion of our population and the general failure to grasp the fundamental principles upon which our whole business structure of production, distribution, and consumption rests, is sometimes terrifying in its magnitude.

Yet these are perhaps incidental to our struggle upward, and if, as a lesson of war, we can learn to think nationally and internationally we may yet learn to think in the terms of sound economics. England has already expressed her apprehension of our growing supremacy in commerce and finance, and other nations are jealous of our immense resources and possibilities. But before these can be developed and our leadership established, it must be justified by demonstration at home of our fitness to be leaders in the world's thought and pace-makers in the world's progress toward a better day.

A generation ago Tennyson, with the eye of a seer, foresaw the march of events and pictured the struggle of today and perhaps the peace of tomorrow in these prophetic words:

> For I dipped into the future, far as human eye could see,
> Saw the vision of the world, and all the wonder that would be;
> Saw the heavens fill with commerce, argosies of magic sails;
> Pilots of the purple twilight, dropping down with costly bales;
> Heard the heavens fill with shouting, and there rained a ghastly dew
> From the nations' airy navies grappling in the central blue;
> Far along the world-wide whisper of the south-wind rushing warm,
> With the standards of the peoples plunging through the thunderstorm;
> Till the war-drum throbb'd no longer, and the battle-flags were furl'd
> In the Parliament of man, the Federation of the world.
> There the common sense of most shall hold a fretful realm in awe,
> And kindly earth shall slumber, lapt in universal law.

NEW YORK STATE DEPARTMENT OF LABOR—THE INDUSTRIAL COMMISSION—ALBANY

THE LABOR MARKET IN OCTOBER, 1917

REVIEWED BY THE BUREAU OF STATISTICS AND INFORMATION

EMPLOYMENT IN FACTORIES

(As reported by 1648 representative firms with over 600,000 employees, or more than one-third of the factory workers in the State, and a weekly payroll of over $10,000,000.)

Returns as to manufacturing activity for October indicate a marked improvement over the high figures of September. During October, which is ordinarily more active than the preceding month, there were employed 2 per cent more people than in September. An increase of 4 per cent in the aggregate of wages paid during the month established a new high record which exceeded that of any other month since these statistics have been compiled. The increase in the volume of wages paid has been so widespread that new records were made not only for the grand total but also for some of the industries of every group. The total wages for each group except three — printing and paper goods, clothing, millinery and laundering, and water, light and power — reached a point in excess of any previous mark. These statements are based on returns, charted on the last page of this Bulletin, received from 1648 factories including all of the important manufacturing industries and localities in the State.

As compared with September there was an increase in wages in every group except water, light and power, while only two of the groups — stone, clay and glass products, and water, light and power — had losses in the number of employees. Although many of the factories were closed on Columbus Day, the average per capita wage for all workers, including men and women in shops and offices, was $17.33 as compared with $16.97 for September and $14.95 for October, 1916. The number of employees when compared with that for October, 1916, 1915 and 1914 indicated gains of 2, 19 and 26 per cent, respectively. The total wages increased 18, 55 and 79 per cent over figures for October of 1916, 1915 and 1914, respectively.

Stone, clay and glass products paid out one and one-half per cent more wages to 1 per cent fewer workers when compared with September. Glass was the only industry where there was an increase in both employees and wages. All of the other industries in this group decreased in both employees and wages paid. The most pronounced decline was in brick, tile and pottery where a strike combined with the usual pre-winter reduction caused a loss of 12 per cent in employees and of 10 per cent in wages paid. As compared with the corresponding month of last year, October had 1 per cent more employees and 15 per cent more wages.

The *metals, machinery and conveyances* group reported the increased payment of 6 per cent in wages and an addition of 3 per cent in the working force as compared with September. This resulted in new records for October both for wages paid and number of employees. Two of the industries — pig iron products and automobiles — established new records for both employees and wages. Machinery reached its high point for the number of employees while 3 industries — gold and silver products, cars and locomotives, and instruments — had a record amount of wages paid for the month. Due to labor trouble the brass, copper and aluminum industry suffered a decrease of somewhat more than 4 per cent in total amount of wages paid. Compared with the corresponding month of last year, the group had in October 7 per cent more workers and paid out 26 per cent more for wages.

The *wood manufactures* group reported that the October payroll exceeded that of September by 3 per cent, whereas the number of workers showed but a slight increase. Each industry of the group had increases in both employees and wages except saw mill and planing mill products which suffered decreases as the result of the annual slackening following its maximum activity in September. A comparison with October, 1916, presents a decrease of almost 5 per cent in employees and an increase of 7 per cent in wages for the entire group.

The *furs, leather and rubber goods* group employed 5 per cent more workers and paid out almost 8 per cent more wages in October than in the preceding month. The entire group and each of its industries except two, paid out a greater volume of wages than at any time since June, 1914. Due to increases in both employees and wages for every industry, this group made greater gains over September, 1917, than any of the other groups. When compared with October, 1916, the group paid 14 per cent more wages to a slight decrease in employees.

The *chemicals* group reported increases of 1 per cent in employees and more than 2 per cent in wages for October when compared with September. Drugs and chemicals, and miscellaneous chemical products, as well as the total for the entire group, broke all former records of wages paid. The group paid 24 per cent more wages to a force increased by 6 per cent over October of last year.

The *paper* industry reported a new high mark for the aggregate of wages paid. A comparison of October with September shows an increase of 2 per cent in employees and 3 per cent in wage volume. When compared with the corresponding month of last year, the data for October indicates the payment of 21 per cent more wages with an addition of 5 per cent in the number of employees.

The *printing and paper goods* group reported that since September there were increases of 2 per cent in the number of employees and 3 per cent in the total wages. Paper boxes and tubes was the only industry showing a decrease. As compared with October, 1916, there were 4 per cent fewer workers and 5 per cent more wages.

The *textiles* group in October had a negligible increase in employees and a gain of 3 per cent in wages as compared with the preceding month. Three of the industries reported gains in both employees and wages. The group employed 3 per cent less people and paid 15 per cent more in wages than in October, 1916. Cotton goods showed the greatest increased activity of any of the industries of this group, when compared with last year.

The *clothing, millinery and laundering* group employed a slightly larger number of people and paid more than 1 per cent additional in total wages in October than in September. Three industries reported decreases in both employees and wages. Losses in women's clothing and women's headwear were seasonal. Government contracts in the men's clothing industry were largely responsible for an eight per cent increase in wages. A comparison with October of last year shows that the entire group paid out 7 per cent additional in total wages with a decrease of 4 per cent in the working force.

The *food, liquors and tobacco* group in October increased its number of employees and the amount of wages by 1½ per cent over September's figures. Increases in both the force and total amount of wages paid were reported by every industry except groceries, which experienced decreases on account of the shortage of raw sugar. In comparison with October, 1916, the group had more than 4 per cent additional employees and paid 16 per cent more wages.

The *water, light and power* group was the only one in which there were decreases in both the number of employees and the total amount of wages when compared with activities for September, there being 1 per cent less workers and a slight loss in the amount of wages paid. As compared with October, 1916, there was reported an increase of 5 per cent in employees and 22 per cent in wage volume.

BUILDING ACTIVITY IN PRINCIPAL CITIES

(As reported by building departments)

The estimated cost of building operations in the ten largest cities in New York State for October, 1917, was 37 per cent less than in September. This is based on reports which show, through the issuance of building permits, the contemplated building activities in these cities.

Only three cities — Albany, Binghamton and Yonkers — reported increases as compared with September. In comparison with October, 1916, there was a loss of 58 per cent for the entire State, with two cities— Binghamton and Buffalo — reporting gains.

WORK OF STATE EMPLOYMENT OFFICES

Figures prepared by the State Employment Bureau show that during October places were sought by 5½ per cent more workers than in the preceding month. The number of employers who called for workers was almost the same as during September. The actual number of positions reported filled was 7206, or six-sevenths of the number of registrants for the month. The operations of the offices located in the five largest cities of the State are shown in tables on page 3.

New York City made the greatest demand for workers while Rochester followed very closely. The number of workers requested during October was 127 less than in the previous month but 1463 in excess of the number sought during the corresponding month of last year.

The places reported filled in October was greater by 545 than the corresponding figure for September. The data for October, 1916, showed that 63 per cent of the requests for employees were reported filled, while for October, 1917, 69 per cent of those requesting workers reported that they had engaged applicants sent by the Bureau.

More success was experienced in filling positions in agriculture than in any other field. Here 79 per cent of the calls for employees were met; domestic and personal service reported 77 per cent. Building, trade and transportation, and manufacturing and mercantile, followed in the order named: the last showing that the number of places reported filled was 48 per cent of the number of workers requested.

COURSE OF EMPLOYMENT IN REPRESENTATIVE MANUFACTURING ESTABLISHMENTS IN NEW YORK STATE

INDUSTRY	PERCENTAGE OF CHANGE IN EACH MONTH COMPARED WITH —								RATIO OF OCTOBER, 1917 TO JUNE, 1914 (JUNE, 1914 = 100)		Weight of each industry in total (per cent of reported employees in October)
	PRECEDING MONTH				SAME MONTH OF PRECEDING YEAR						
	EMPLOYEES		TOTAL WAGES		EMPLOYEES		TOTAL WAGES				
	Sept., 1917	Oct., 1917	Sept., 1917	Oct., 1917	Sept., 1917	Oct., 1917	Sept., 1917	Oct., 1917	Employees	Total wages	
Stone, Clay and Glass Products	+0.4	—0.8	+4.7	+1.4	+0.5	+0.9	+14.0	+15.4	**107**	**154**	**2.6**
Miscellaneous stone and mineral products	—0.2	—2.6	+5.1	—2.1	+21.3	+20.2	+28.7	+28.0	197	246	0.7
Lime, cement and plaster	—4.2	—2.6	—1.2	—3.3	—1.0	—5.6	+15.8	+7.0	84	119	0.5
Brick, tile and pottery	—2.0	—11.9	—3.6	—10.1	—6.6	—10.4	+7.9	+6.2	68	97	0.6
Glass	+7.3	+12.9	+18.1	+19.3	—9.3	—1.4	+3.2	+16.1	122	186	0.8
Metals, Machinery and Conveyances	+4.0	+3.0	+7.7	+5.8	+5.4	+7.0	+22.5	+26.3	**153**	**217**	**37.8**
Gold, silver and precious stones	—0.6	—1.3	+3.9	+0.4	—0.8	—4.0	+17.0	+8.4	114	156	0.7
Brass, copper, aluminum, etc	—2.9	+3.9	+6.8	—4.3	—14.4	—12.9	+3.5	—4.0	170	243	2.7
Pig iron and rolling mill products	+2.5	+5.4	+4.1	+10.7	+12.7	+15.1	+37.0	+46.2	164	289	2.8
Structural and architectural iron work	+1.4	+3.3	+1.8	—0.4	—1.4	—0.3	+11.1	+9.9	101	127	0.5
Sheet metal work and hardware	—0.6	+1.2	+4.0	+2.6	—2.9	—0.2	+18.1	+22.0	122	165	2.7
Firearms, tools and cutlery	+7.9	+21.4	+17.9	+21.7	—27.4	—8.4	—14.2	+5.0	217	331	1.7
Cooking, heating and ventilating apparatus	+7.1	—2.3	+10.1	—2.9	+19.0	+10.6	+41.6	+31.9	127	191	1.2
Machinery	+0.9	+1.4	+4.4	+3.7	+10.4	+10.2	+23.3	+26.7	152	201	10.8
Automobiles, carriages and parts	+6.0	+2.3	+8.4	+6.1	+22.4	+20.4	+40.4	+39.0	281	369	5.3
Cars, locomotives and railway repair shops	+2.4	+2.2	+5.4	+10.3	+6.0	+5.9	+25.2	+33.7	124	193	5.2
Boat and ship building	+68.4	+24.2	+59.8	+17.7	+0.3	+30.7	+19.1	+46.0	190	249	1.0
Instruments and appliances	+14.9	—0.7	+17.4	+3.4	+8.3	+5.5	+17.4	+16.9	117	145	3.2
Wood Manufactures	—2.1	+0.3	+1.4	+3.2	—4.8	—4.7	+7.2	+6.9	**101**	**136**	**4.4**
Saw mill and planing mill products	—2.6	—5.6	—2.9	—4.6	—4.3	—7.9	+8.4	+4.7	88	112	1.0
Furniture and cabinet work	—2.6	+1.1	—0.2	+4.0	—8.3	—7.5	+3.1	+3.8	104	136	1.4
Pianos, organs and other musical instruments	—0.6	+2.8	+8.1	+6.8	—2.1	—2.0	+7.8	+4.2	104	163	1.0
Miscellaneous wood and allied products	—2.5	+3.2	+2.4	+7.7	—2.8	+0.5	+12.4	+19.9	111	147	1.0
Furs, Leather and Rubber Goods	—4.7	+5.4	—2.1	+7.7	—4.6	—0.7	+10.7	+14.0	**124**	**168**	**7.5**
Leather	+0.8	§	+1.8	+1.7	+13.0	+5.7	+31.9	+21.3	132	203	0.4
Furs and fur goods	+0.5	+3.4	+14.7	+3.3	—1.4	+0.7	+30.4	+15.1	153	270	0.4
Boots and shoes	—10.1	+7.9	—9.1	+9.5	—11.0	—3.9	*	+7.4	127	160	4.1
Miscellaneous leather and canvas goods	+3.1	+4.2	+6.9	+9.8	+8.4	+5.6	+26.4	+25.2	100	135	1.1
Rubber and gutta percha goods	—0.2	+0.2	+3.9	+4.6	+20.8	+21.8	+47.7	+53.6	148	219	0.8
Pearl, horn, bone, celluloid, hair, etc	+5.9	+3.0	+9.2	+5.7	—15.7	—13.1	—2.4	§	113	159	0.7
Chemicals, Oils, Paints, Etc	—1.2	+0.8	+0.7	+2.3	+4.0	+6.1	+20.8	+24.1	**131**	**173**	**5.5**
Drugs and chemicals	+0.2	—0.2	—0.8	+2.7	+12.2	+10.7	+25.9	+25.4	144	180	1.4
Paints, dyes and colors	—7.3	—0.3	—5.3	+1.6	+3.6	+3.9	+11.3	+14.3	99	115	0.4
Animal and mineral oil products	—1.0	+0.7	+1.3	+1.0	+0.7	+3.8	+20.2	+23.8	144	203	2.5
Miscellaneous chemical products	—0.8	+2.7	+2.9	+5.0	+2.7	+6.8	+20.0	+26.2	110	142	1.2
Paper	+2.2	+2.2	+4.3	+2.8	+3.9	+5.1	+20.3	+21.4	**113**	**161**	**1.5**
Printing and Paper Goods	—0.2	+1.5	+2.4	+2.5	—5.3	—3.6	+2.5	+5.0	**104**	**119**	**7.2**
Paper boxes and tubes	—1.8	—0.9	+1.6	—1.9	—10.3	—10.2	—1.4	—3.2	101	125	1.0
Miscellaneous paper goods	+8.2	+1.9	+10.3	+0.9	—7.0	—6.7	+5.7	+3.6	98	118	1.0
Printing and book making	—1.4	+1.9	+1.5	+3.4	—3.9	—1.4	+2.6	+6.4	106	118	5.2
Textiles	+1.3	+0.1	+5.7	+2.9	—1.9	—2.6	+12.3	+14.7	**104**	**143**	**10.7**
Silk and silk goods	+1.1	+2.3	+6.8	+6.2	+6.2	+5.0	+17.6	+23.4	108	137	1.9
Wool manufactures	—0.2	—0.6	+7.7	+3.2	—17.2	—17.5	—4.8	—1.8	88	126	2.5
Cotton goods	—0.4	+1.5	+3.8	+1.3	+23.8	+14.3	+47.0	+42.4	123	184	1.1
Cotton and woolen hosiery and knit goods	+4.3	—1.3	+5.9	+2.2	+3.1	+3.4	+19.3	+23.0	112	155	3.3
Other textiles and allied products	—0.8	+0.7	+3.2	+1.7	—5.1	—4.2	+9.3	+8.3	100	139	1.9
Clothing, Millinery, Laundering, Etc	+3.4	+0.5	+7.1	+1.4	—4.9	—4.1	+1.4	+7.2	**100**	**128**	**13.6**
Men's clothing	—2.2	+2.0	—2.7	+7.7	+1.8	+5.9	+8.1	+20.0	103	126	3.9
Men's shirts and furnishings	+0.6	+2.6	+4.5	+4.9	—9.1	—9.6	—8.3	—5.9	101	118	3.3
Women's clothing	+8.8	—4.0	+14.1	—4.9	—8.5	—9.2	—4.2	+4.1	96	140	3.0
Women's underwear and furnishings	+10.3	+4.0	+10.4	+6.1	—10.0	—7.0	+5.0	+7.9	92	120	1.3
Women's headwear	+34.4	—1.2	+55.9	—10.5	+1.0	—2.6	+30.9	+16.3	106	144	0.6
Miscellaneous sewing	+1.1	—1.0	+2.2	—1.5	+6.9	+6.2	+13.1	+10.6	129	146	0.7
Laundering, cleaning, dyeing, etc	—3.2	†	—3.4	+2.2	—7.9	—8.0	+1.1	+0.6	88	112	0.8
Food, Liquors and Tobacco	+3.7	+1.4	+2.7	+1.4	+5.2	+4.6	+17.3	+15.9	**102**	**130**	**8.5**
Flour, feed and other cereal products	+8.8	+2.8	+3.6	+10.5	—3.7	+1.1	+4.7	+22.0	121	158	0.4
Fruit and vegetable canning and preserving	—0.1	+2.5	+9.3	+12.9	—5.6	+3.8	+5.0	+18.2	97	153	0.6
Groceries not elsewhere classified	+0.6	—14.9	—3.8	—19.1	+19.0	—2.6	+34.6	+0.4	98	121	1.3
Slaughtering, meat packing and dairy products	—0.2	+2.4	+2.2	+3.2	+2.1	+6.4	+17.4	+21.4	102	133	0.6
Bread and other bakery products	+5.2	+2.1	+5.7	+4.8	+1.4	+6.2	+12.3	+19.6	115	146	1.8
Confectionery and ice cream	+12.9	+12.8	+15.0	+13.9	+4.6	+6.5	+20.5	+22.4	148	186	1.0
Beverages	—1.7	+2.9	—4.7	+0.9	—0.3	+0.2	+4.9	+5.3	101	107	0.8
Cigars and other tobacco products	+4.6	+6.9	+6.5	+9.3	+8.4	+9.8	+22.3	+28.1	82	111	2.0
Water, Light and Power	+2.1	—1.0	+3.3	—0.3	+5.4	+4.5	+21.6	+22.0	**99**	**126**	**0.7**
Total	+1.9	+1.9	+5.1	+4.1	+0.8	+2.0	+15.1	+18.2	**120**	**166**	**100.0**

* Increase of less than 0.05 per cent. † Decrease of less than 0.05 per cent. § No change.

COURSE OF EMPLOYMENT IN REPRESENTATIVE MANUFACTURING ESTABLISHMENTS IN NEW YORK CITY

Industry Groups	Percentage of Change in Each Month Compared With —								Number of Representative Establishments and Employees, October, 1917			
	PRECEDING MONTH				SAME MONTH OF PRECEDING YEAR				TOTAL STATE		NEW YORK CITY	
	EMPLOYEES		TOTAL WAGES		EMPLOYEES		TOTAL WAGES					
	Sept., 1917	Oct., 1917	Sept., 1917	Oct., 1917	Sept., 1917	Oct., 1917	Sept., 1917	Oct., 1917	Establishments	Employees	Establishments	Employees
Ste, clay and glass products	—6	+5	—4	—4	—13	—7	—2	†	73	15,349	26	3,248
Mls, machinery and conveyances	+3	+2	+6	*	*	+2	+10	+12	346	229,400	96	42,551
Wd manufactures	—1	*	+1	+4	—5	—4	+4	+5	135	26,640	55	13,270
Fu, leather and rubber goods	—9	+12	—6	+15	—3	+6	+14	+21	141	45,649	75	17,067
Chnicals, oils, paints, etc	—4	+2	†	+2	*	+4	+15	+22	57	33,174	29	9,836
Par	+2	—1	+1	*	—9	—10	+3	+15	26	9,117	92	31,645
Pring and paper goods	—1	+1	+2	+2	—7	—5	+1	+3	141	43,453		
Teiles	*	+2	+7	+6	—3	—1	+9	+15	147	65,141	30	11,790
Cling,millinery, laundering, etc	+6	+1	+10	+2	—3	—1	+4	+13	398	82,388	304	53,699
Fo, liquors and tobacco	+5	+1	+4	+1	+6	+5	+19	+17	171	51,848	66	33,116
Wer, light and power	+3	—2	+7	—1	+9	+11	+26	+29	13	4,256	7	2,262
Total	+1	+2	+4	+2	—2	*	+8	+12	1,648	606,415	780	218,484

* Increase of less than 0.5 per cent. † Decrease of less than 0.5 per cent.

COMPARISON OF PERSONS SEEKING WORK AND WORKERS CALLED FOR AT STATE PUBLIC EMPLOYMENT OFFICES: BY QUARTERS

1915–1917: Quarters	Workers Seeking Employment (Registrations and Renewals)			Workers Called For by Employers			Excess of —	
	Males	Females	Total	Males	Females	Total	Registrations and renewals	Workers requested
umer Quarter, 1915 (June, July, August)	15,265	5,868	21,133	5,687	3,823	9,510	11,623	....
Aumn Quarter, 1915 (September, October, November)	12,037	5,736	17,773	8,452	5,232	13,684	4,089	....
Wier Quarter, 1915–16 (December, January, February)	10,421	5,577	15,998	6,768	5,707	12,475	3,523	....
Spig Quarter, 1916 (March, April, May†)	11,530	5,272	16,802	12,740	8,158	20,898	....	4,096
Sumer Quarter, 1916 (June, July, August†)	11,201	4,359	15,560	12,839	8,192	21,031	....	5,471
Aumn Quarter, 1916 (September, October, November†)	13,089	5,494	18,583	15,164	10,067	25,231	....	6,648
Wier Quarter, 1916–17 (December, January, February§†)	13,452	5,315	18,767	13,001	9,512	22,513	....	3,746
Spig Quarter, 1917 (March, April, May¶)	18,683	6,784	25,467	19,023	12,181	31,204	....	5,737
Sumer Quarter, 1917 (June, July, August*)	16,895	6,517	23,412	19,023	11,596	30,619	....	7,207
Sepember, 1917¶‡	5,797	2,217	8,014	6,362	4,235	10,597	....	2,583
Ocber, 1917¶‡	5,807	2,643	8,450	6,305	4,167	10,472	....	2,022

† Includes Auburn and Williamsburg offices. § Includes office at Oswego for February. ¶ Includes Auburn, Oswego, Queens and Williamsburg offices.
‡ Includes Mineola office. * Includes Auburn, Oswego, Queens and Williamsburg offices for June and July; Mineola office added in August.

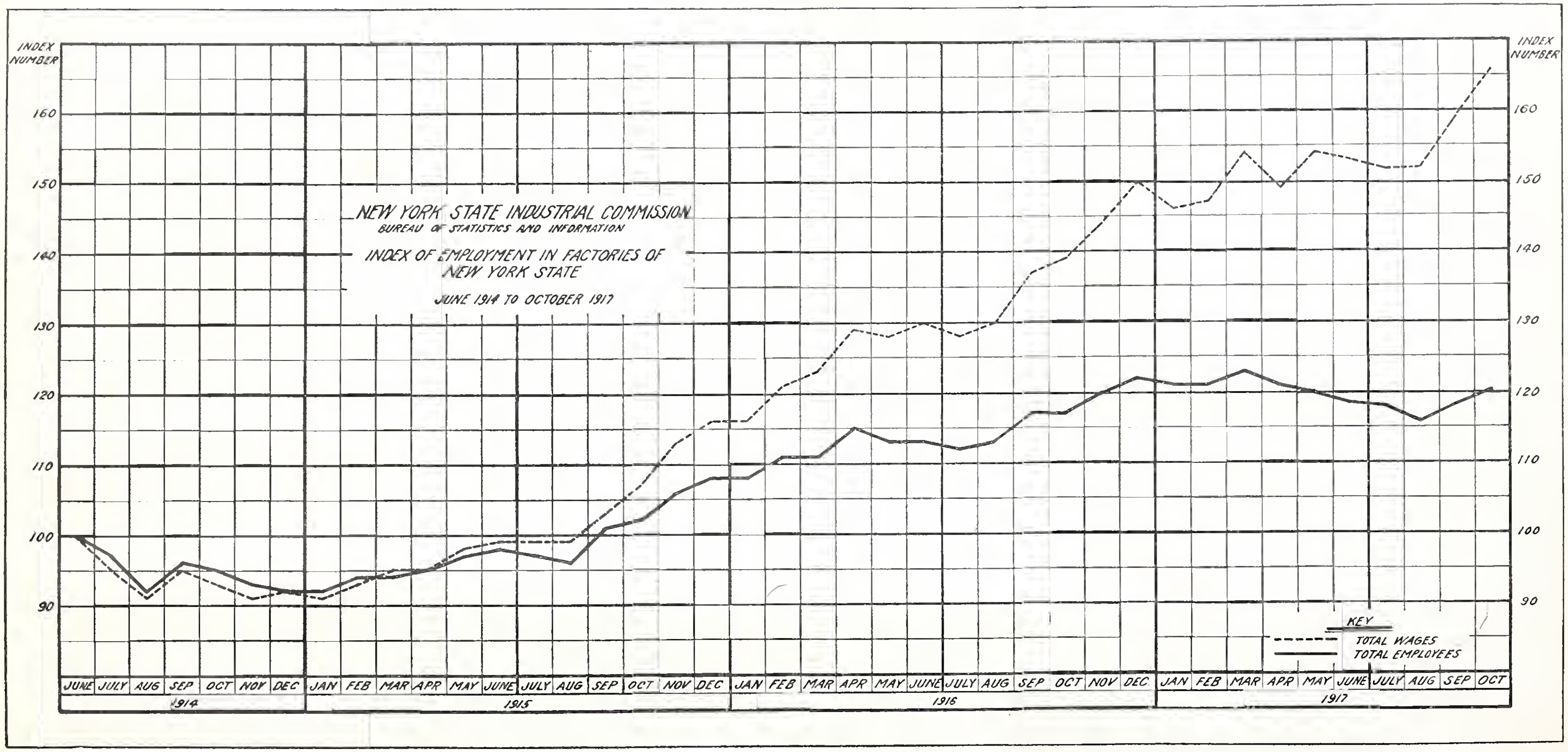
WORKERS CALLED FOR AND PLACES REPORTED FILLED AT STATE PUBLIC EMPLOYMENT OFFICES: BY INDUSTRIES AND CITIES

	Total	Industries					Cities				
		Agriculture	Building	Manufacturing and mercantile	Trade and transportation	Domestic and personal service	New York City	Buffalo	Rochester	Syracuse	Albany
Wkers requested:											
September, 1916	7,842	392	1,818	1,518	736	3,378	1,911	1,966	§1,681	1,420	864
September, 1917	10,597	2,164	1,429	1,866	798	4,340	††2,862	2,138	§2,837	*1,802	958
October, 1916	9,009	496	2,074	1,716	783	3,940	2,495	2,118	§2,262	1,296	838
October, 1917	10,472	1,519	1,682	2,035	884	4,352	††2,852	2,234	§2,673	*1,741	972
Plaes reported filled:											
September, 1916	4,755	293	1,185	647	332	2,298	1,185	1,421	§980	734	435
September, 1917	6,661	1,422	1,015	833	365	3,026	††1,864	1,937	§1,186	*1,065	609
October, 1916	5,671	324	1,398	813	360	2,776	1,601	1,581	§1,183	790	516
October, 1917	7,206	1,191	1,169	969	527	3,350	††1,858	1,884	§1,716	*1,108	640

§ Includes Auburn office. * Includes Oswego office. †† Includes Brooklyn, Mineola, Queens and Williamsburg offices.

ESTIMATED COST OF BUILDING WORK (NEW, ALTERATIONS, AND REPAIRS) AUTHORIZED IN FIRST AND SECOND CLASS CITIES

Cities	September, 1917		October, 1917		October, 1916		Percentage of Change	
	Total	Therof new buildings	Total	Thereof new buildings	Total	Thereof new buildings	September, 1917, to Oct., 1917	Oct., 1916, to Oct., 1917
Alny	$150,572	$115,011	$174,120	$55,400	$408,895	$317,000	+15.6	—57.4
Bihamton	65,107	30,735	243,867	215,796	130,929	102,761	+274.6	+86.3
Bualo	1,064,000	1,022,200	1,014,000	958,500	972,000	819,100	—4.7	+4.3
Ne York City	8,210,587	5,552,319	4,488,819	3,396,986	13,410,627	11,592,880	—45.3	—66.5
Manhattan	*3,425,889*	*1,915,300*	*1,582,798*	*858,500*	*6,776,606*	*6,009,800*	*—53.8*	*—76.6*
Brooklyn	*2,950,747*	*2,009,015*	*1,225,170*	*1,082,950*	*3,187,089*	*2,518,950*	*—58.5*	*—61.6*
Bronx	*302,313*	*193,600*	*387,786*	*300,500*	*1,192,032*	*925,450*	*+28.3*	*—67.5*
Queens	*1,066,385*	*993,785*	*1,046,049*	*934,305*	*1,756,245*	*1,672,525*	*—1.9*	*—40.4*
Richmond	*465,253*	*440,619*	*247,016*	*220,731*	*498,655*	*466,155*	*—46.9*	*—50.5*
Rcester	915,877	831,505	608,959	541,191	1,032,370	931,168	—33.6	—41.0
Scnectady	205,446	192,465	104,643	87,705	122,670	107,630	—49.1	—14.7
Sycuse	329,902	242,716	221,834	146,864	463,865	412,784	—32.8	—52.2
Tr	195,180	188,000	15,339	5,339	62,875	33,200	—92.1	—75.6
Uta	231,600	222,650	108,675	95,950	238,275	216,675	—53.1	—54.4
Yckers	91,700	51,600	184,100	157,600	272,600	264,300	+100.8	—32.5
Total	$11,459,971	$8,449,201	$7,164,356	$5,661,331	$17,115,106	$14,797,498	—37.5	—58.1



NEW YORK STATE INDUSTRIAL COMMISSION
BUREAU OF STATISTICS AND INFORMATION

INDEX OF EMPLOYMENT IN FACTORIES OF NEW YORK STATE

JUNE 1914 TO OCTOBER 1917

THIRD SUPPLEMENT
TO
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MONDAY, 4 MARCH, 1918.

War Office,
4th March, 1918.

The following Despatch has been received by the Secretary of State for War from Field-Marshal Sir Douglas Haig, K.T., G.C.B., G.C.V.O., Commanding-in-Chief British Armies in France:—

General Headquarters,
British Armies in the Field,
20th February, 1918.

MY LORD,

I have the honour to submit the following Report on the operations on the Cambrai front during November and December, 1917.

GENERAL PLAN.

(1) As pointed out in my last Despatch, the object of these operations was to gain a local success by a sudden attack at a point where the enemy did not expect it. Our repeated attacks in Flanders and those of our Allies elsewhere had brought about large concentrations of the enemy's forces on the threatened fronts, with a consequent reduction in the garrisons of certain other sectors of his line.

Of these weakened sectors the Cambrai front had been selected as the most suitable for the surprise operation in contemplation. The ground there was, on the whole, favourable for the employment of tanks, which were to play an important part in the enterprise, and facilities existed for the concealment of the necessary preparations for the attack.

If, after breaking through the German defence systems on this front, we could secure Bourlon to the north, and establish a good flank position to the east, in the direction of Cambrai, we should be well placed to exploit the situation locally between Bourlon and the Sensee River and to the north-west. The capture of Cambrai itself was subsidiary to this operation, the object of our advance towards that town being primarily to cover our flank and puzzle the enemy regarding our intentions.

The enemy was laying out fresh lines of defence behind those which he had already completed on the Cambrai front; and it was to be expected that his troops would be redistributed as soon as our pressure in Flanders was relaxed. He had already brought large forces from Russia in exchange for Divisions exhausted in the struggle in the Western theatre, and it was practically certain that heavy reinforcements would be brought from East to West during the winter. Moreover his tired Divisions, after a winter's rest, would recover their efficiency.

For all these reasons, if the existing opportunity for a surprise attack were allowed to lapse, it would probably be many months before an equally favourable one would again offer itself. Furthermore, having regard to the future, it was desirable to show the enemy that he could not with impunity reduce his garrisons beyond a certain point without incurring grave risks.

Against these arguments in favour of immediate action I had to weigh the fact that my own troops had been engaged for many months in heavy fighting, and that, though their efforts had been uniformly successful, the conditions of the struggle had greatly taxed their strength. Only part of the losses in my Divisions had been replaced, and many recently arrived drafts, still far from being fully trained, were included in the ranks of the Armies. Under these conditions it was a serious matter to make a further heavy call on my troops at the end of such a strenuous year.

On the other hand, from the nature of the operation, the size of the force which could be employed was bound, in any case, to be comparatively small, since success depended so much on secrecy, and it is impossible to keep secret the concentration of very large forces. The demand made upon my resources, therefore, should not be a great one.

While considering these different factors, preparations were quietly carried on, so that all might be ready for the attack if I found it possible to carry it out. The success of the enemy's offensive in Italy subsequently added great force to the arguments in favour of undertaking the operation, although the means at my disposal for the purpose were further reduced as a consequence of the Italian situation.

Eventually I decided that, despite the various limiting factors, I could muster enough force to make a first success sufficiently sure to justify undertaking the attack, but that the degree to which this success could be followed up must depend on circumstances.

It was calculated that, provided secrecy could be maintained to the last moment, no large hostile reinforcements were likely to reach the scene of action for forty-eight hours after the commencement of the attack. I informed General the Hon. Sir Julian Byng, K.C.B., K.C.M.G., M.V.O., to whom the execution of the plans in connection with the Cambrai operations was entrusted, that the advance would be stopped by me after that time, or sooner if necessary unless the results then gained and the general situation justified its continuance.

The general plan of attack was to dispense with previous artillery preparation, and to depend instead on tanks to smash through the enemy's wire, of which there was a great quantity protecting his trenches.

As soon as the advance of the tanks and infantry, working in close co-operation, began, the artillery was to assist with counter-battery and barrage work; but no previous registration of guns for this purpose could be permitted, as it would rouse the enemy's suspicions. The artillery of our new Armies was therefore necessarily subjected to a severe test in this operation, and proved itself entirely worthy of the confidence placed in it.

The infantry, tanks, and artillery thus working in combination were to endeavour to break through all the enemy's lines of defence on the first day. If this were successfully accomplished and the situation developed favourably, cavalry were then to be passed through to raid the enemy's communications, disorganise his system of command, damage his railways, and interfere as much as possible with the arrival of his reinforcements. It was explained to all Commanders that everything depended on secrecy up to the moment of starting, and after that on bold, determined and rapid action. Unless opposition could be beaten down quickly, no great results could be looked for.

The Commander-in-Chief of the French Armies, to whom I secretly communicated my plans, most readily agreed to afford me every assistance. In addition to the steps taken by him to engage the enemy's attention elsewhere, he arranged for a strong force of French infantry and cavalry to be in a position whence they could be moved forward rapidly to take part in the exploitation of our success, if the situation should render it possible to bring them into action. On the 20th November certain of these French units were actually put in motion. The course of events, however, did not open out the required opportunity for their employment, but the French forces were held in readiness and within easy reach so long as there appeared to be any hope of it. Had the situation on the 20th November developed somewhat more favourably in certain directions, the nature of which will become apparent in the course of this report, the presence and co-operation of these French troops would have been of the greatest value.

THE ENEMY'S DEFENCES.

(2) The German defences on this front had been greatly improved and extended since the opening of our offensive in April, and comprised three main systems of resistance.

The first of these three trench systems, constituting part of the Hindenburg Line proper, ran in a general north-westerly direction for a distance of six miles from the Canal de l'Escaut at Banteux to Havrincourt. There it turned abruptly north along the line of the Canal du Nord for a distance of four miles to Mœuvres, thus forming a pronounced salient in the German front.

In advance of the Hindenburg Line the enemy had constructed a series of strong forward positions, including La Vacquerie and the north-eastern corner of Havrincourt Wood. Behind it, and at distances respectively varying from a little less to rather more than a mile, and from three-and-a-half to four-and-a-half miles lay the second and third main German systems, known as the Hindenburg Reserve Line, and the Beaurevoir, Masnières, Marquion Lines.

THE ATTACK.

(3) All necessary preparations were completed in time, and with a secrecy reflecting the greatest credit on all concerned. At 6.20 a.m. on the 20th November, without any previous artillery bombardment, tanks and infantry attacked on a front of about six miles

from east of Gonnelieu to the Canal du Nord opposite Hermies.

At the same hour, demonstrations with gas, smoke and artillery took place on practically the whole of the British front south of the Scarpe, and subsidiary attacks were launched east of Epehy and between Bullecourt and Fontaine-lez-Croisilles.

On the principal front of attack, the tanks moved forward in advance of the infantry, crushing down the enemy's wire and forming great lanes through which our infantry could pass. Protected by smoke barrages from the view of the enemy's artillery, they rolled on across the German trenches, smashing up the enemy's machine guns and driving his infantry to ground. Close behind our tanks our own infantry followed and, while the tanks patrolled the line of hostile trenches, cleared the German infantry from their dug-outs and shelters.

In this way, both the main system of the Hindenburg Line and its outer defences were rapidly overrun, and tanks and infantry proceeded in accordance with programme to the attack upon the Hindenburg Reserve Line.

In this advance, the 12th (Eastern) Division, moving along the Bonavis Ridge on the right of our attack, encountered obstinate resistance at Lateau Wood, which sheltered a number of German batteries. Fierce fighting, in which infantry and tank crews displayed the greatest gallantry, continued throughout the morning at this point, and ended in the capture of the position, together with the enemy's guns.

Meanwhile, the 20th (Light) Division, which had captured La Vacquerie at the opening of its attack, stormed the powerful defences of Welsh Ridge. The 6th Division carried the village of Ribecourt, after sharp fighting among the streets and houses, while the 62nd (West Riding) Division (T.) stormed Havrincourt, where also parties of the enemy held out for a time.

The capture of these two villages secured the flanks of the 51st (Highland) Division (T.), advancing on the left centre of our attack up the slopes of Flesquieres Hill against the German trench lines on the southern side of Flesquieres village. Here very heavy fighting took place. The stout brick wall skirting the Chateau grounds opposed a formidable obstacle to our advance, while German machine guns swept the approaches. A number of tanks were knocked out by direct hits from German field batteries in position beyond the crest of the hill. None the less, with the exception of the village itself, our second objectives in this area were gained before midday.

Many of the hits upon our tanks at Flesquieres were obtained by a German artillery officer who, remaining alone at his battery, served a field gun single-handed until killed at his gun. The great bravery of this officer aroused the admiration of all ranks.

On the left of our attack west of the Canal du Nord, the 36th (Ulster) Division captured a German strong point on the spoil bank of the canal and pushed northwards in touch with the West Riding troops, who, as the first stage in a most gallant and remarkably successful advance, had taken Havrincourt. By 10.30 a.m. the general advance beyond the Hindenburg Reserve Line to our final objectives had begun and cavalry were moving up behind our infantry.

In this period of the attack tanks and British infantry battalions of the 29th Division entered Masnieres and captured Marcoing and Neuf Wood, securing the passages of the Canal de l'Escaut at both villages.

At Marcoing the tanks arrived at the moment when a party of the enemy were in the act running out an electrical connection to blow up one of the bridges. This party was fired on by a tank and the bridge secured intact. At Masnieres, however, the retreating enemy succeeded in destroying partially the bridge carrying the main road. In consequence the first tank which endeavoured to cross at this point fell through the bridge, completing its destruction.

The advance of a number of our guns had been unavoidably delayed in the sunken roads which served this part of the battlefield, and though our infantry continued their progress beyond Masnieres, without the assistance of tanks and artillery they were not able at first to clear the enemy entirely from the northern portion of the village. Here parties of Germans held out during the afternoon, and gave the enemy time to occupy Rumilly and the section of the Beaurevoir-Masnieres line south of it; while the destruction of the bridge also prevented the cavalry from crossing the canal in sufficient strength to overcome his resistance.

In spite of this difficulty, a squadron of the Fort Garry Horse, Canadian Cavalry Brigade, succeeded during the afternoon in crossing the canal by a temporary bridge constructed during the day. This squadron passed through the Beaurevoir-Masnieres line and charged and captured a German battery in position to the east of it. Continuing its advance, it dispersed a body of about 300 German infantry, and did not cease its progress until the greater part of its horses had been killed or wounded. The squadron thereupon took up a position in a sunken road, where it maintained itself until night fell. It then withdrew to our lines, bringing with it several prisoners taken in the course of a most gallant exploit.

Meanwhile, west of the Canal de l'Escaut patrols of the 6th Division during the afternoon entered Noyelles-sur-l'Escaut, where they were reinforced by cavalry, and other cavalry units pushed out towards Cantaing. West of Flesquieres, the 62nd Division, operating northwards from Havrincourt, made important progress. Having carried the Hindenburg Reserve Line north of that village, it rapidly continued its attack and captured Graincourt, where two anti-tank guns were destroyed by the tanks accompanying our infantry. Before nightfall infantry and cavalry had entered Anneux, though the enemy's resistance in this village does not appear to have been entirely overcome until the following morning.

This attack of the 62nd (West Riding) Division constitutes a brilliant achievement, in which the troops concerned completed an advance of four and a half miles from their original front, over-running two German systems of defence and gaining possession of three villages.

On the left flank of our attack Ulster battalions pushed northwards along the Hindenburg Line and its forward defences, maintaining touch with the West Riding troops, and carried the whole of the German trench systems west of the Canal du Nord far north as the Bapaume-Cambrai road.

At the end of the first day of the attack, therefore, three German systems of defence had been broken through to a depth of some four and a half miles on a wide front, and over 5,000 prisoners had already been brought in. But for the wrecking of the bridge at Masnieres and the check at Flesquieres still greater results might have been attained.

Throughout these operations the value of the services rendered by the tanks was very great, and the utmost gallantry, enterprise and resolution were displayed by both officers and crews. In combination with the other arms they helped to make possible a remarkable success. Without their aid in opening a way through the German wire success could only have been attained by methods which would have given the enemy ample warning of our attack, and have allowed him time to mass troops to oppose it. As has been pointed out above, to enable me to undertake such an operation with the troops at my disposal secrecy to the last moment was essential. The tanks alone made it possible to dispense with artillery preparation, and so to conceal our intentions from the enemy up to the actual moment of attack.

Great credit is due also to the Royal Flying Corps for very gallant and most valuable work carried out under conditions of the greatest difficulty from low clouds and driving mist.

In the subsidiary attack at Bullecourt battalions of the 3rd Division and the 16th (Irish) Division successfully completed the work begun by our operations in this area in May and June, 1917, capturing the remainder of the Hindenburg support trench on their front, with some 700 prisoners. A number of counter-attacks against our new positions at Bullecourt on this and the following day were repulsed, with great loss to the enemy.

The Advance Continued.

(4) On the morning of the 21st November the attack on Flesquieres was resumed, and by 8.0 a.m. the village had been turned from the north-west and captured. The obstacle which more than anything else had limited the results of the 20th November was thereby removed, and later in the morning the advance once more became general.

Masnieres had been cleared of the enemy during the previous evening, and at 11.0 a.m. our troops attacked the Beaurevoir-Masnieres line and established themselves in the portion to the east and north of Masnieres. Heavy fighting took place, and a counter-attack from the direction of Rumilly was beaten off. At the same hour we attacked and captured Les Rues des Vignes, but later in the morning the enemy counter-attacked and compelled our troops to fall back from this position. Progress was also made towards Crevecoeur; but though the canal was crossed during the afternoon, it was found impossible to force the passage of the river in face of the enemy's machine-gun fire.

That evening orders were issued by the Third Army to secure the ground already gained in this area of the battle, and to capture Rumilly on the morrow; but in consequence of the exhaustion of the troops engaged it was found necessary later in the night to cancel the orders for this attack.

West of the Canal de l'Escaut infantry of the 29th Division and dismounted regiments of the 1st and 5th Cavalry Divisions, including the Ambala Brigade, were heavily engaged throughout the day in Noyelles, and beat off all attacks in continuous fighting.

Following upon the capture of Flesquieres, the 51st and 62nd Divisions, in co-operation with a number of tanks and squadrons of the 1st Cavalry Division, attacked at 10.30 a.m. in the direction of Fontaine-notre-Dame and Bourlon.

In this attack the capture of Anneux was completed, and early in the afternoon Cantaing was seized, with some hundreds of prisoners. Progress was made on the outskirts of Bourlon Wood, and late in the afternoon Fontaine-notre-Dame was taken by troops of the 51st Division and tanks. The attack on Bourlon Wood itself was checked by machine-gun fire, though tanks advanced some distance into the wood.

Farther west, the 36th Division advanced north of the Bapaume-Cambrai road, and reached the southern outskirts of Moeuvres, where strong opposition was encountered.

The Position on the 21st November.

(5) On the evening of the second day of the attack, therefore, our troops held a line which ran approximately as follows:—

From our old front line east of Gonnelieu the right flank of our new positions lay along the eastern slopes of the Bonavis Ridge, passing east of Lateau Wood and striking the Masnieres-Beaurevoir line north of the Canal de l'Escaut at a point about half way between Crevecoeur and Masnieres. From this point our line ran roughly north-west, past and including Masnieres, Noyelles and Cantaing, to Fontaine, also inclusive. Thence it bent back to the south for a short distance, making a sharp salient round the latter village, and ran in a general westerly direction along the southern edge of Bourlon Wood and across the southern face of the spur to the west of the wood, to the Canal du Nord, south-east of the village of Moeuvres. From Moeuvres the line linked up once more with our old front at a point about midway between Bourcies and Pronville.

The forty-eight hours after which it had been calculated that the enemy's reserves would begin to arrive had in effect expired, and the high ground at Bourlon village and wood, as well as certain important tactical features to the east and west of the wood, still remained in the enemy's possession. It now became necessary to decide whether to continue the operation offensively or to take up a defensive attitude and rest content with what had been attained.

The Decision to Go On.

(6) It was not possible, however, to let matters stand as they were. The positions captured by us north of Flesquieres were completely commanded by the Bourlon Ridge, and unless this ridge were gained it would be impossible to hold them, except at excessive cost. If I decided not to go on a withdrawal to the Flesquieres Ridge would be necessary, and would have to be carried out at once.

On the other hand, the enemy showed certain signs of an intention to withdraw. Craters had been formed at road junctions, and troops could be seen ready to move east. The possession of Bourlon Ridge would enable our troops to obtain observation over the ground to the north, which sloped gently down to the Sensee River. The enemy's defensive lines south of the Scarpe and Sensee Rivers would thereby be turned, his communications exposed to the observed fire of our artillery, and his positions in this sector jeopardised. In short, so great was the importance of the ridge to the enemy that its loss would probably cause the abandonment by the Germans of their carefully prepared defence systems for a considerable distance to the north of it.

The successive days of constant marching and fighting had placed a very severe strain upon the endurance of the troops, and, before a further advance could be undertaken, some time would have to be spent in resting and relieving them. This need for delay was regrettable, as the enemy's forces were increasing, and fresh German divisions were known to be arriving, but, with the limited number of troops at my command, it was unavoidable.

It was to be remembered, however, that the hostile reinforcements coming up at this stage could at first be no more than enough to replace the enemy's losses; and although the right of our advance had definitely been stayed, the enemy had not yet developed such strength about Bourlon as it seemed might not be overcome by the numbers at my disposal. As has already been pointed out, on the Cambrai side of the battlefield I had only aimed at securing a defensive flank to enable the advance to be pushed northwards and north-westwards, and this part of my task had been to a large extent achieved.

An additional and very important argument in favour of proceeding with my attack was supplied by the situation in Italy, upon which a continuance of pressure on the Cambrai front might reasonably be expected to exercise an important effect, no matter what measure of success attended my efforts. Moreover, two divisions previously under orders for Italy had on this day been placed at my disposal, and with this accession of strength the prospect of securing Bourlon seemed good.

After weighing these various considerations, therefore, I decided to continue the operations to gain the Bourlon position.

The 22nd November was spent in organising the captured ground, in carrying out certain reliefs, and in giving other troops the rest they greatly needed. Soon after mid-day the enemy regained Fontaine-notre-Dame; but, with our troops already on the outskirts of Bourlon Wood and Cantaing held by us, it was thought that the recapture of Fontaine should not prove very difficult. The necessary arrangements for renewing the attack were therefore pushed on, and our plans were extended to include the recapture of Fontaine-notre-Dame.

Meanwhile, early in the night of the 22nd November, a battalion of the Queen's Westminsters stormed a commanding tactical point in the Hindenburg Line west of Mœuvres known as Tadpole Copse, the possession of which would be of value in connection with the left flank of the Bourlon position when the latter had been secured.

THE STRUGGLE FOR BOURLON RIDGE.

(7) On the morning of the 23rd November the 51st Division, supported by tanks, attacked Fontaine-notre-Dame, but was unable to force an entrance. Early in the afternoon this division repeated its attack from the west, and a number of tanks entered Fontaine, where they remained till dusk, inflicting considerable loss on the enemy. We did not succeed, however, in clearing the village, and at the end of the day no progress had been made on this part of our front.

At 10.30 a.m. the 40th Division attacked Bourlon Wood, and after four-and-a-half hours of hard fighting, in which tanks again rendered valuable assistance to our infantry, captured the whole of the wood and entered Bourlon Village. Here hostile counter-attacks prevented our further progress, and though the village was at one time reported to have been taken by us, this proved later to be erroneous. A heavy hostile attack upon our positions in the wood, in which all three battalions of the 9th Grenadier Regiment appear to have been employed, was completely repulsed.

Throughout this day, also, the 36th Division and troops of the 56th (London) Division (T.) were engaged in stubborn fighting in the neighbourhood of Mœuvres and Tadpole Copse, and made some progress.

This struggle for Bourlon resulted in several days of fiercely contested fighting, in which English, Scottish, Welsh and Irish battalions, together with dismounted cavalry, performed most gallant service and inflicted heavy loss on the enemy.

During the morning of the 24th November the enemy twice attacked, and at his second attempt pressed back our troops in the north-eastern corner of the wood. An immediate counter-attack delivered by the 14th Battalion, Argyll and Sutherland Highlanders, the 15th Hussars, dismounted, and the remnants of the 119th Infantry Brigade, drove back the enemy in turn, and by noon our line had been re-established. Meanwhile, dismounted cavalry had repulsed an attack on the high ground west of Bourlon Wood, and in the afternoon a third hostile attack upon the wood was stopped by our artillery and rifle fire.

On this afternoon our infantry again attacked Bourlon Village, and captured the whole of it. Later in the evening a fourth attack upon our positions in the wood was beaten off after fierce fighting. Further progress was made on this day in the Hindenburg Line west of Mœuvres, but the enemy's resistance in the whole of this area was very strong.

On the evening of the 25th November a fresh attack by the enemy regained Bourlon Village, though our troops offered vigorous resistance, and parties of the 13th Battalion, East Surrey Regiment, held out in the south-east corner of the village until touch was re-established with them two days later. The continual fighting and the strength of the enemy's attacks, however, had told heavily on the 40th Division, which had borne the brunt of the struggle. This division was accordingly withdrawn, and on the following day our troops were again pressed back slightly in the northern outskirts of Bourlon Wood.

With the enemy in possession of the shoulder of the ridge above Fontaine-notre-Dame, as well as of part of the high ground west of Bourlon Wood, our position in the wood itself was a difficult one, and much of the ground to the south of it was still exposed to the enemy's observation. It was decided, therefore, to make another effort on the 27th November to capture Fontaine-notre-Dame and Bourlon Village, and to gain possession of the whole of the Bourlon Ridge.

In this attack, in which tanks co-operated, British Guards temporarily regained possession of Fontaine-notre-Dame, taking some hundreds of prisoners, and troops of the 62nd Division once more entered Bourlon Village. Later in the morning, however, heavy counter-attacks developed in both localities and our troops were unable to maintain the ground they had gained. During the afternoon the enemy also attacked our positions at Tadpole Copse, but was repulsed.

As the result of five days of constant fighting, therefore, we held a strong position on the Bourlon Hill and in the wood, but had not yet succeeded in gaining all the ground required for the security of this important feature. The two following days passed comparatively quietly, while the troops engaged were relieved and steps were undertaken to prepare for a deliberate attack which might give us the tactical points we sought.

Meanwhile, on other parts of the front the organisation of our new positions was proceeding as rapidly as conditions would allow. In particular, troops of the 12th Division had effected some improvement on the right flank of our advance opposite Banteux, and the 16th Division had made further progress in the Hindenburg Line north-west of Bullecourt.

At the end of November the number of prisoners taken in our operations south-west of Cambrai exceeded 10,500. We had also captured 142 guns, some 350 machine guns, and 70 trench mortars, with great quantities of ammunition, material and stores of all kinds.

THE GERMAN ATTACK: EARLY WARNINGS.

(8) During the last days of November increased registration of hostile artillery, the movements of troops and transport observed behind the German lines, together with other indications of a like nature, pointed to further efforts by the enemy to regain the positions we had wrested from him.

The front affected by this increased activity included that of our advance, as well as the ground to Vendhuille and beyond. The massing of the enemy's infantry, however, his obvious anxiety concerning the security of his defences south of the Sensee River, the tactical importance of the high ground about Bourlon, and the fact that we were still only in partial possession of it, all pointed to the principal attack being delivered in the Bourlon sector.

OUR DISPOSITIONS FOR DEFENCE.

(9) Measures were accordingly taken, both by the Third Army and by the lower formations concerned, to prepare for eventualities. Arrangements had been made after our last attack to relieve the troops holding the Bourlon positions by such fresh divisions as were available, and when these reliefs had been satisfactorily completed, I felt confident that the defence of this sector could be considered secure.

Covering our right flank from Cantaing to the Banteux Ravine, a distance of about 16,000 yards, five British divisions were disposed, and, though these had been fighting for several days and were consequently tired, I felt confident that they would prove equal to stopping any attack the enemy could make on them.

From the Banteux Ravine southwards the divisions in line were weak and held very extended fronts. On the other hand, the line held by us in this southern sector had been in our possession for some months. Its defences were for this reason more complete and better organised than those of the ground gained by us in our attack. Moreover, the capture of the Bonavis Ridge had added to the security of our position farther south.

The reserve divisions immediately available in the area consisted of the Guards and 2nd Cavalry Divisions, both of which had been engaged in the recent fighting at Fontaine and Bourlon Wood. These were located behind the La Vacquerie-Villers Guislain front, while another division, the 62nd, which had also been recently engaged, was placed farther to the north-west in the direction of the Bapaume-Cambrai road. A fresh South Midland Division was assembling farther back, two other cavalry divisions were within from two to three hours march of the battle area, and another cavalry division but a little farther distant.

In view of the symptoms of activity observed on the enemy's front, special precautions were taken by local commanders, especially from Villers Guislain to the south. Troops were warned to expect attack, additional machine guns were placed to secure supporting points, and divisional reserves were closed up. Special patrols were also sent out to watch for signs of any hostile advance.

THE BATTLE REOPENED.

(10) Between the hours of 7 and 8 a.m. on the last day of November the enemy attacked, after a short but intense artillery preparation, on the greater part of a front of some ten miles from Vendhuille to Masnieres inclusive. From Masnieres to Banteux, both inclusive, four German divisions would seem to have been employed against the three British divisions holding this area. Between Banteux exclusive and Vendhuille one German division and portions of two others were employed against the northern half of the British division holding that front.

On the Masnieres front the 29th Division, composed of English, Scottish, Welsh, Irish, Guernsey and Newfoundland battalions, although seriously threatened as the day wore on by the progress made by the enemy farther south, where their battery positions had been taken in reverse, most gallantly beat off a succession of powerful assaults, and maintained their line intact.

At the northern end of the Bonavis Ridge and in the Gonnelieu sector the swiftness with which the advance of the enemy's infantry followed the opening of his bombardment appears to have overwhelmed our troops, both in line and in immediate support, almost before they had realised that the attack had begun.

The nature of the bombardment, which seems to have been heavy enough to keep our men under cover without at first seriously alarming them, contributed to the success of the enemy's plans. No steadily advancing barrage gave warning of the approach of the German assault columns, whose secret assembly was assisted by the many deep folds and hollows typical of a chalk formation, and shielded from observation from the air by an early morning mist. Only when the attack was upon them great number of low-flying German aeroplanes rained machine gun fire upon our infantry, while an extensive use of smoke shell and bombs made it extremely difficult for our troops to see what was happening on other parts of the battlefield, or to follow the movements of the enemy. In short, there is little doubt that, although an attack was expected generally, yet in these areas of the battle at the moment of delivery the assault effected a local surprise.

None the less, stubborn resistance was offered during the morning by isolated parties of our troops and by machine gun detachments in the neighbourhood of Lateau Wood and south-east of La Vacquerie, as well as at other points. In more than one instance heavy losses are known to have been inflicted on the enemy by machine gun fire at short range. North-east of La Vacquerie the 92nd Field Artillery Brigade repulsed four attacks, in some of which the enemy's infantry approached to within 200 yards of our guns before the surviving gunners were finally compelled to withdraw, after removing the breech-blocks from their pieces. East of Villers Guislain the troops holding our forward positions on the high ground were still offering a strenuous resistance to the enemy's attack on their front at a time when large forces of German infantry had already advanced up the valley between them and Villers Guislain. South of this village a single strong point known as Limerick Post, garrisoned by troops of the 1/5th Bn. (King's Own), Royal Lancaster Regiment, and the 1/10th Bn., Liverpool Regiment, held out with great gallantry throughout the day, though heavily attacked.

The progress made by the enemy, however, across the northern end of the Bonavis Ridge and up the deep gully between Villers Guislain and Gonnelieu, known as 22 Ravine, turned our positions on the ridge as well as in both villages. Taken in flank and rear, the defences of Villers Guislain, Gonnelieu, and Bonavis were rapidly overrun. Gouzeaucourt was captured about 9.0 a.m., the outer defences of La Vacquerie were reached, and a number of guns which had been brought up close to the line in order to enable them to cover the battle-front about Masnieres and Marcoing fell into the hands of the enemy.

At this point the enemy's advance was checked by the action of our local reserves, and meanwhile measures had been taken with all possible speed to bring up additional troops. About midday the Guards came into action west of Gouzeaucourt, while cavalry moved up to close the gap on their right and made progress towards Villers Guislain from the south and south-west.

The attack of the Guards, which was delivered with the greatest gallantry and resolution, drove the enemy out of Gouzeaucourt and made progress on the high ground known as the St. Quentin Ridge, east of the village. In this operation the Guards were materially assisted by the gallant action of a party of the 29th Division, who, with a company of North Midland Royal Engineers, held on throughout the day to a position in an old trench near Gouzeaucourt. Valuable work was also done by a brigade of field artillery of the 47th Division, which moved direct into action from the line of march.

During the afternoon three battalions of tanks, which when they received news of the attack were preparing to move away from the battlefield to refit, arrived at Gouzeaucourt and aided the infantry to hold the recaptured ground. Great credit is due to the officers and men of the Tank Brigade concerned for the speed with which they brought their tanks into action.

Meanwhile, the defence of La Vacquerie had been successfully maintained, and our line had been established to the north of that village, in touch with our troops in Masnieres.

THE NORTHERN ATTACK.

(11) In the northern area, from Fontaine-notre-Dame to Tadpole Copse, the German attack was not launched until some two hours later. This was the enemy's main attack, and was carried out with large forces and great resolution.

After a heavy preliminary bombardment, and covered by an artillery barrage, the enemy's infantry advanced shortly after 9 a.m. in dense waves, in the manner of his attacks in the first battle of Ypres. In the course of the morning and afternoon no less than five principal attacks were made in this area, and on one portion of the attack as many as eleven waves of German infantry advanced successively to the assault. On the whole of this front a resolute endeavour was made to break down by sheer weight of numbers the defence of the London Territorials and other English battalions holding the sector.

In this fighting the 47th (London) Division (T.), the 2nd Division and the 56th (London) Division (T.) greatly distinguished themselves, and there were accomplished many deeds of great heroism.

Under the fury of the enemy's bombardment a company of the 17th Battalion, Royal Fusiliers, were in the course of being withdrawn from an exposed position in a sap-head in advance of our line between Bourlon Wood and Moeuvres when the German attack burst upon them. The officer in command sent three of his platoons back, and with a rearguard composed of the remainder of his company held off the enemy's infantry until the main position had been organized. Having faithfully accomplished their task, this rearguard died fighting to the end with their faces to the enemy.

Somewhat later in the morning an attack in force between the Canal du Nord and Moeuvres broke into our foremost positions and isolated a company of the 13th Battalion, Essex Regiment, in a trench just west of the canal. After maintaining a splendid and successful resistance throughout the day, whereby the pressure upon our main line was greatly relieved, at 4 p.m. this company held a council of war, at which the two remaining company officers, the company sergeant-major, and the platoon sergeants were present, and unanimously determined to fight to the last and have "no surrender." Two runners who were sent to notify this decision to Battalion Headquarters succeeded in getting through to our lines and delivered their message. During the remainder of the afternoon and far into the following night this gallant company were heard fighting, and there is little room for doubt that they carried out to a man their heroic resolution.

Early in the afternoon large masses of the enemy again attacked west of Bourlon Wood, and, though beaten off with great loss at most points, succeeded in overwhelming three out of a line of posts held by a company of the 1st Battalion, Royal Berks Regiment, on the right of the 2nd Division. Though repeatedly attacked by vastly superior numbers the remainder of these posts stood firm, and when, two days later, the three posts which had been overpowered were regained, such a heap of German dead lay in and around them that the bodies of our own men were hidden.

All accounts go to show that the enemy's losses in the whole of his constantly repeated attacks on this sector of the battle front were enormous. One battery of eight machine-guns fired 70,000 rounds of ammunition into ten successive waves of Germans. Long lines of attacking infantry were caught by our machine-gun fire in enfilade, and were shot down in line as they advanced. Great execution also was done by our field artillery, and in the course of the battle guns were brought up to the crest line and fired direct upon the enemy at short range.

At one point west of Bourlon the momentum of his first advance carried the enemy through our front line and a short way down the southern slopes of the ridge. There, however, the German masses came under direct fire from our field artillery at short range and were broken up. Our local reserves at once counter-attacked, and succeeded in closing the gap that had been made in our line. Early in the afternoon the enemy again forced his way into our foremost positions in this locality, opening a gap between the 1/6th Battalion and the 1/15th Battalion, London Regiments. Counter-attacks, led by the two battalion commanders, with all available men, including the personnel of their headquarters, once more restored the situation. All other attacks were beaten off with the heaviest losses to the enemy.

The greatest credit is due to the troops at Masnieres, Bourlon and Moeuvres for the very gallant service performed by them on this day. But for their steady courage and staunchness in defence, the success gained by the enemy on the right of our battle front might have had serious consequences.

I cannot close the account of this day's fighting without recording my obligation to the Commander-in-Chief of the French Armies for the prompt way in which he placed French troops within reach for employment in case of need at the unfettered discretion of the Third Army Commander. Part of the artillery of this force actually came into action, rendering valuable service, and though the remainder of the troops were not called upon, the knowledge that they were available should occasion arise was a great assistance.

THE FIGHTING AT GONNELIEU AND MASNIERES.

(12) On the 1st December fighting continued fiercely on the whole front.

The Guards completed the capture of the St. Quentin Ridge and entered Gonnelieu, where they captured over 350 prisoners and a large number of machine-guns. Tanks took an effective part in the fighting for the ridge. At one point, where our infantry were held up by fire from a hostile trench, a single tank attacked and operated up and down the trench, inflicting heavy losses on the enemy's garrison. Our infantry were then able to advance and secure the trench, which was found full of dead Germans. In it were also found fifteen machine-guns that had been silenced by the tank. In the whole of this fighting splendid targets were obtained by all tank crews, and the German casualties were seen to be very great.

Farther south, a number of tanks co-operated with dismounted Indian cavalry of the 5th Cavalry Division and with the Guards in the attacks upon Villers Guislain and Gauche Wood, and were in great measure responsible for the capture of the wood. Heavy fighting took place for this position, which it is clear that the enemy had decided to hold at all costs. When the infantry and cavalry finally took possession of the wood, great numbers of German dead and smashed machine-guns were found. In one spot four German machine-guns, with dead crews lying round, were discovered within a radius of twenty yards. Three German field guns, complete with teams, were also captured in this wood.

Other tanks proceeded to Villers Guislain, and, in spite of heavy direct artillery fire, three reached the outskirts of the village, but the fire of the enemy's machine-guns prevented our troops advancing from the south from supporting them, and the tanks ultimately withdrew.

Severe fighting took place, also, at Masnieres. During the afternoon and evening at least nine separate attacks were beaten off by the 29th Division on this front, and other hostile attacks were repulsed in the neighbourhood of Marcoing, Fontaine-notre-Dame, and Bourlon. With the Bonavis Ridge in the enemy's hands, however, Masnieres was exposed to attack on three sides, and on the night of the 1st/2nd December our troops were withdrawn under orders to a line west of the village.

On the afternoon of the 2nd December a series of heavy attacks developed against Welsh Ridge in the neighbourhood of La Vacquerie, and further assaults were made on our positions in the neighbourhood of Masnieres and Bourlon. These attacks were broken in succession by our machine-gun fire, but the enemy persisted in his attempts against Welsh Ridge and gradually gained ground. By nightfall our line had been pushed back to a position west and north of Gonnelieu.

Next day the enemy renewed his attacks in great force on the whole front from Gonnelieu to Marcoing, and ultimately gained possession of La Vacquerie. North of La Vacquerie repeated attacks made about Masnieres and Marcoing were repulsed in severe fighting, but the positions still retained by us beyond the Canal de l'Escaut were extremely exposed, and during the night our troops were withdrawn under orders to the west bank of the canal.

THE WITHDRAWAL FROM BOURLON.

(13) By this time the enemy had evidently become exhausted by the efforts he had made and the severity of his losses, and the 4th December passed comparatively quietly. For some days, however, local fighting continued in the neighbourhood of La Vacquerie, and his attitude remained aggressive. Local attacks in this sector were repulsed on the 5th December, and on this and the following two days further fierce fighting took place, in which the enemy again endeavoured without success to drive us from our positions on Welsh Ridge.

The strength which the enemy had shown himself able to develop in his attacks made it evident that only by prolonged and severe fighting could I hope to re-establish my right flank on the Bonavis Ridge. Unless this was done, the situation of my troops in the salient north of Flesquieres would be difficult and dangerous, even if our hold on Bourlon Hill were extended.

I had therefore to decide either to embark on another offensive battle on a large scale, or to withdraw to a more compact line on the Flesquieres Ridge.

Although this decision involved giving up important positions most gallantly won, I had no doubt as to the correct course under the conditions. Accordingly, on the night of the 4th/5th December the evacuation of the positions held by us north of the Flesquieres Ridge was commenced. On the morning of the 7th December this withdrawal was completed successfully without interference from the enemy.

Before withdrawing the more important of the enemy's field defences were destroyed, and those of his guns which we had been unable to remove were rendered useless. The enemy did not discover our withdrawal for some time, and when, on the afternoon of the 5th December, he began to feel his way forward, he did so with great caution. In spite of his care, on more than one occasion bodies of his infantry were caught in the open by our artillery.

Much skill and courage were shown by our covering troops in this withdrawal, and an incident which occurred on the afternoon of the 6th December in the neighbourhood of Graincourt deserves special notice. A covering party, consisting of two companies of the 1/15th Battalion, London Regiment, 47th Division, much reduced in strength by the fighting at Bourlon Wood, found their flank exposed by a hostile attack farther east, and were enveloped and practically cut off. These companies successfully cut their way through to our advanced line of resistance, where they arrived in good order, after having inflicted serious casualties on the enemy.

The new line taken up by us corresponded roughly to the old Hindenburg Reserve Line, and ran from a point about one and a half miles north by east of La Vacquerie, north of Ribecourt and Flesquieres to the Canal du Nord, about one and a half miles north of Havrincourt—*i.e.*, between two and two and a half miles in front of the line held by us prior to the attack of the 20th November. We therefore retained in our possession an important section of the Hindenburg trench system, with its excellent dug-outs and other advantages.

THE RESULTS OF THE BATTLE.

(14) The material results of the three weeks' fighting described above can be stated in general terms very shortly.

We had captured and retained in our possession over 12,000 yards of the former German front line from La Vacquerie to a point opposite Boursies, together with between 10,000 and 11,000 yards of the Hindenburg Line and Hindenburg Reserve Line and the villages of Ribecourt, Flesquieres and Havrincourt. A total of 145 German guns were taken or destroyed by us in the course of the operations, and 11,100 German prisoners were captured.

On the other hand, the enemy had occupied an unimportant section of our front line between Vendhuille and Gonnelieu.

There is little doubt that our operations were of considerable indirect assistance to the Allied forces in Italy. Large demands were made upon the available German reserves at a time when a great concentration of German Divisions was still being maintained in Flanders. There is evidence that German Divisions intended for the Italian theatre were diverted to the Cambrai front, and it is probable that the further concentration of German forces against Italy was suspended for at least two weeks at a most critical period, when our Allies were making their first stand on the Piave Line.

GENERAL REVIEW.

(15) I have already summarised in the opening paragraphs of this Despatch both the reasons which decided me to undertake the Cambrai operations and the limitations to which those operations were subject.

In view of the strength of the German forces on the front of my attack, and the success with which secrecy was maintained during our preparations, I had calculated that the enemy's prepared defences would be captured in the first rush. I had good hope that his resisting power behind those defences would then be so enfeebled for a period that we should be able on the same day to establish ourselves quickly and completely on the dominating Bourlon Ridge from Fontaine-notre-Dame to Moeuvres, and to secure our right flank along a line including the Bonavis Ridge, Crevecoeur and Rumilly to Fontaine-notre-Dame. Even if this did not prove possible within the first twenty-four hours, a second day would be at our disposal before the enemy's reserves could begin to arrive in any formidable numbers.

Meanwhile, with no wire and no prepared defences to hamper them, it was reasonable to hope that masses of cavalry would find it possible to pass through, whose task would be thoroughly to disorganise the enemy's systems of command and inter-communication in the whole area between the Canal de l'Escaut, the River Sensee and the Canal du Nord, as well as to the east and north-east of Cambrai.

My intentions as regards subsequent exploitation were to push westward and northwestward, taking the Hindenburg Line in reverse from Mœuvres to the River Scarpe, and capturing all the enemy's defences and probably most of his garrisons lying west of a line from Cambrai northwards to the Sensee, and south of that river and the Scarpe.

Time would have been required to enable us to develop and complete the operation; but the prospects of gaining the necessary time, by the use of cavalry in the manner outlined above, were in my opinion good enough to justify the attempt to execute the plan. I am of opinion that on the 20th and 21st November we went very near to a success sufficiently complete to bring the realisation of our full programme within our power.

The reasons for my decision to continue the fight after the 21st November have already been explained. Though in the event no advantage was gained thereby, I still consider that, as the problem presented itself at the time, the more cautious course would have been difficult to justify. It must be remembered that it was not a question of remaining where we stood, but of abandoning tactical positions of value, gained with great gallantry, the retention of which seemed not only to be within our power, but likely even yet to lead to further success.

Whatever may be the final decision on this point, as well as on the original decision to undertake the enterprise at all with the forces available, the continuation of our efforts against Fontaine-notre-Dame gave rise to severe fighting, in which our troops more than held their own.

On the 30th November risks were accepted by us at some points in order to increase our strength at others. Our fresh reserves had been thrown in on the Bourlon front, where the enemy brought against us a total force of seven divisions to three and failed. I do not consider that it would have been justifiable on the indications to have allotted a smaller garrison to this front.

Between Masnieres and Vendhuille the enemy's superiority in infantry over our divisions in line was in the proportion of about four to three, and we were sufficiently provided with artillery. That his attack was partially successful may tend to show that the garrison allotted to this front was insufficient, either owing to want of numbers, lack of training, or exhaustion from previous fighting.

Captured maps and orders have made it clear that the enemy aimed at far more considerable results than were actually achieved by him. Three convergent attacks were to be made on the salient formed by our advance; two of them delivered approximately simultaneously about Gonnelieu and Masnieres, followed later by a still more powerful attack on the Bourlon front The objectives of these attacks extended to the high ground at Beaucamp and Trescault, and the enemy's hope was to capture and destroy the whole of the British forces in the Cambrai salient.

This bold and ambitious plan was foiled on the greater part of our front by the splendid defence of the British divisions engaged; and, though the defence broke down for a time in one area, the recovery made by the weak forces still left and those within immediate reach is worthy of the highest praise. Numberless instances of great gallantry, promptitude and skill were shown, some few of which have been recounted.

I desire to acknowledge the skill and resource displayed by General Byng throughout the Cambrai operations, and to express my appreciation of the manner in which they were conducted by him, as well as by his Staff and the subordinate commanders.

In conclusion, I would point out that the sudden breaking through by our troops of an immense system of defence has had a most inspiring moral effect on the Armies I command, and must have a correspondingly depressing influence upon the enemy. The great value of the tanks in the offensive has been conclusively proved. In view of this experience, the enemy may well hesitate to deplete any portion of his front, as he did last summer, in order to set free troops to concentrate for decisive action at some other point.

I have the honour to be,
My Lord,
Your obedient Servant,
D. HAIG,
Field-Marshal,
Commanding-in-Chief,
British Armies in France

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British Medicine in the War

1914–1917

JAM REBUS QUISQUE RELICTIS
NATURAM PRIMUM STUDEAT COGNOSCERE RERUM.

LONDON:
THE BRITISH MEDICAL ASSOCIATION.
1917.

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Being Essays on Problems of Medicine, Surgery, and Pathology arising among the British Armed Forces engaged in this War and the manner of their solution.

Collected out of the BRITISH MEDICAL JOURNAL, April—October, 1917.

WITH COLOURED PLATES AND NUMEROUS ILLUSTRATIONS IN THE TEXT

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THE BRITISH MEDICAL ASSOCIATION.
1917.

PREFACE.

Felix qui potuit rerum cognoscere causas.

A CHARACTERISTIC of British medicine from the sixteenth century to the present day has been its readiness to test all theories by the appeal to Nature. This disposition was in accord with the instinct for practical affairs of a race which has been compelled constantly to engage in war and has endeavoured always to wage war humanely. Three centuries ago Harvey, the greatest name in British medicine, in his oft-quoted injunction "ever to search out and study the secrets of Nature by way of experiment," struck the note which has been dominant ever since. The purpose of the following pages is twofold. It is intended to give a brief account of the manner in which the spirit that has inspired British medicine since the days of Harvey has, by the application of scientific principles to practice and administration, mitigated the hardships and sufferings of those engaged in this war, and it is intended also to point out how, by the wise utilization of the services of members of the British medical profession, as practitioners of the art or students of the sciences on which it depends, problems rendered acute by war or newly brought to light by it have been studied, and in many instances partially or completely solved even during its continuance.

Harvey's injunction has been the watchword of British physiology and pathology. The principle it embodied was handed on by a long line of successors through Hales, Priestley, Young, and Hunter, to Lister, who, guided by the fundamental observations and doctrines of Pasteur, brought about by experiment and trial a revision of the institutes of surgery. The story in its main aspect is told by Sir Berkeley Moynihan in the eloquent essay, remarkable for its philosophic grasp, its learning, and its cordial tributes to the work of men of other nations, which forms the first chapter of this volume.

At about the time when Hunter by his direct appeal to Nature was giving so great an impetus to the study of pathology, and helping to found the science of comparative anatomy, there arose in Great Britain a school of investigators which sought out the causes of epidemic diseases by observation of the conditions under which they spread and by the study of statistics of their incidence. Guided by these investigations methods of prevention were devised which, when tested in the Navy, the Army, and among the civil population, were not found wanting. The problem of scurvy, the scourge of navies and commercial shipping, was attacked and solved; the problems of typhus and relapsing fever were attacked, and the relation of these diseases to overcrowding, dirt, and famine established. Another great step forward was made when it was shown that by the application of administrative measures founded on inquiry and observation—by ensuring the purity of water supplies, by the canalization of sewage and the removal of refuse—the incidence of typhoid fever might be enormously diminished. The new science of bacteriology, due at its inception mainly to the prescience of Pasteur, put a new weapon into the hands of civil and military medical administrators, and in its effective use this country has not been backward. Pasteur, when giving to the world his doctrine of artificial immunity through the inoculation of attenuated virus, paid a generous tribute to the achievement of Edward Jenner in devising vaccination against small-pox—a means of preventing that disease so effective that the horror it inspired a century ago is now completely forgotten. It is in accordance with historical fitness that antityphoid vaccination, which has proved so efficient a prophylactic in this war, should have been conceived and perfected by another British physician, Sir Almroth Wright. The system, severely tested before the war in the British Army in India, and, with some independent differences in method, in the French Colonial Army, has been applied on a large scale to the armies of both nations with remarkable success since the war began, and even by the enemy to theirs.

The extension of British commerce and the acquisition of territory in tropical and subtropical countries early compelled attention to the epidemic diseases of hot climates. The chief of these was malaria, which, though not peculiar to hot countries, attained in modern times its greatest extension and severity in them. It was the main cause that so many of the richest tracts on the earth's surface were uninhabitable by the white races, and were only governed by them at a heavy cost in life. Even after it was proved that extensive drainage schemes might diminish their incidence, malarial diseases continued the despair of administrators. Here again the clue was afforded by a French observer when Laveran, in Algiers, showed that malaria was associated with the presence of a parasite in the blood; later it was ascertained that the paroxysms of the disease coincided with a certain stage in the life-cycle of the parasite, and that different types of the disease were attended by different varieties of the malarial haematozoon. Striking as these observations were, they did not afford effective means of prevention until the brilliant hypothesis of Manson, founded on the observations on filaria made by him when practising in China, that the mosquito was the intermediate host of the haematozoon, was verified by Ronald Ross, then an officer of the Indian Medical Service. The identification of the species of mosquito that acted as host, and the study of its life-cycle and habitat quickly made plain the main lines prophylactic measures should take. Among the first applications of the new knowledge were those made in the Suez Canal zone under the direction of Ross, at the request of Prince d'Arenberg, and on a still larger scale during the construction of the Panama Canal, where the results were even more striking.

The impetus given to the study of medical entomology by these observations and their practical outcome in the case of malaria was very great. The main incidents in the course of the astonishingly rapid development of this new field of medicine are sketched in Chapter XI by Sir Patrick Manson himself. The whole story is comprised within his lifetime, and to the progress made he has largely contributed not only by his own untiring studies, but by the inspiration he has given to his pupils to search out these secrets of Nature by way of experiment and observation.

At the outbreak of the war the Medical Services of the British Navy and Army each consisted of a corps of commissioned officers with, under their command, non-commissioned officers and men trained, after enlistment, in their special duties. The officers were recruited from among young men who had completed their education in the universities and civilian medical schools and entered the service by competitive examination. The Indian Medical Service, recruited in the same way and containing officers of British or Indian birth, is organized on a military basis, but the majority of its members in peace are employed in civilian posts. Along with subordinate medical services, military and civil, recruited entirely in India, it formed the medical war reserve for India.

The officers of the Naval, Army, and Indian Medical Services underwent, during a period of probation, courses of instruction in special subjects, including tropical diseases, at the Royal Naval or the Royal Army Medical College, and were trained in administration at military hospitals and in camps of instruction. Thus these services consisted of medical officers, experts in their special duties, but numerically insufficient for the great expansion in the armed forces necessitated by a war on a scale larger than had ever been officially contemplated. In the case of the army this numerical insufficiency quickly became very great. The Navy and Army Medical Services both had small reserves of officers who were immediately called up. The Territorial Force, raised for home defence by voluntary enlistment during peace, had its own medical officers, civilian practitioners who had voluntarily accepted the obligation to undergo annual training and to serve with the Force when mobilized. In 1907 Sir Alfred Keogh, G.C.B., then Director-General of Army Medical Services, propounded a scheme for the organization of the Territorial Medical Service. Thanks to his great powers of organization and the confidence felt in his character and attainments by the medical profession his scheme obtained the cordial co-operation of all the leading practitioners throughout the country. It provided regimental medical officers and divisional staffs and the personnel and equipment for twenty-two General Military Hospitals in various centres officered for the most part by the members of the staffs of the large local civilian hospitals. The Territorial Medical Service was mobilized with the rest of the Territorial Force in the early days of August, 1914, but it was realized from the first that the war would be long—Lord Kitchener gave a minimum of three years—and on an unparalleled scale of magnitude. Large new armies were raised by voluntary recruitment, and civilian medical men volunteered so freely that it was not until the spring of 1916 that any form of compulsion was necessary to obtain an adequate supply of medical officers for the new armies.

The nucleus of the medical service for the large British armies now afoot was formed by the small specialized corps which existed on a peace establishment, but eleven-twelfths of the officers of the Royal Army Medical Corps and of the Canadian, Australian, New Zealand, and South African Medical Corps, now serving with the armies in France, Salonica, Egypt and Palestine, Mesopotamia, India, and Africa, were civilian practitioners at the outbreak of war. The present organization of the corps, and the work it is doing, is described in Chapter XIV. Happily the services of Sir Alfred Keogh were again available to direct the necessary expansion. The record discloses an admirable foresight in the creation of a body which could be so expanded and yet remain co-ordinate in its parts.

At an early stage a plan was formed to appoint distinguished members of the staffs of civilian hospitals to be consulting physicians and surgeons with the army in France. It was put into force, as soon as the armies came to fixed positions after the battle of the Marne, under the direction of Sir Arthur Sloggett, Director-General Army Medical Services, who had removed his head quarters to France, while Sir Alfred Keogh took his place in London. As the British forces in France increased until a number of armies were in the field, consulting surgeons and physicians were appointed to each, and for areas in which base hospitals were established. The plan was extended to armies acting in other parts of the world, and also to the area of each military command in the United Kingdom. These consultants go to the military hospitals for purposes of consultation with the medical and surgical staffs, and those with the armies in the field visit the field ambulances, the casualty clearing stations, and the other medical units in the advanced or "collecting" zone (Chapter XIV). The nature of the services rendered by them, and their value, may perhaps be surmised from this brief statement. Passing frequently from one medical unit to another they carry the experience from one to the other so that a broad view can be gained of tendencies to disease and in treatment: they are able to advise the chief administrative medical officers as to means that should be taken to prevent disease or anticipate infection, and to afford opportunities for efficient treatment at the earliest possible moment. Experiences are collected and compared, meetings of the medical officers of an army are held for discussion, and the consultants of all the armies meet together until finally opinion on some problem or set of problems can be crystallized into a memorandum of advice which is issued for information and guidance to all the medical officers of all the armies.

The Royal Naval Medical Service was at the beginning of the war more nearly at war strength than the army, but the increase of ships and personnel of the British Navy has made it necessary to enlarge the medical service of the navy, not only by calling up the reserve but by enlisting the services of many temporary officers and by the appointment of civilian physicians and surgeons of eminence to act as consultants. The Naval Medical Service, like that of the army, has relied on laboratory investigations to help to the solution of problems, some of which were similar to those with which the army was confronted, but it has also had its own special problems in research and administration, and these are described by a number of naval medical officers on the active list in Chapter V, entitled " Medicine and the Sea Affair."

The Medical Service of the British Army went into this war with the advantage of accumulated experiences of epidemic disease derived in part from military and in part from civil life. The most recent military experience on a large scale was that of the war in South Africa (1899–1902). In that war, owing mainly to the climatic conditions, to the scanty population, to the pastoral character of most of the farming, and to the consequent absence of intensive cultivation of the soil, the surgery was relatively simple, whereas prevention of epidemic disease proved to be a task with which, under the special conditions of that war, the Army Medical Service, having the organization and personnel it then possessed, was unable effectively to cope. As in so many previous wars the army was scourged by typhoid fever, which caused large epidemics, undoubtedly due to polluted drinking water, and smaller outbreaks of which the cause could not certainly be ascertained, and which, therefore, could not have been prevented. Probably with our present better knowledge, gained in the main in laboratories at home and in India, of the etiology of the disease and its congeners, and of the menace to any military force created by hale carriers of the infecting microbe, much more might have been done. As it was, commanding officers had to see their plans for the future upset by epidemics on a large scale, such as that of typhoid fever at Bloemfontein, which presented all the features of an outbreak due to polluted water.

In this war the surprise in store for the medical service in France was the frequency and severity of wound infections. A difficulty besetting bedside medicine and surgery is to eliminate the uncertainties due on the one hand to variations in the constitutional vigour of the patient and his power of resisting disease, and on the other to the varying skill and experience of the physician or surgeon. As all the men in the British armies were in the prime of life it was thought that the first cause of uncertainty might be eliminated. Consequently when, in the winter of 1914, there began to be seen both in France and among the men sent home many cases of wound infection of a kind and severity unknown to surgeons trained in the Listerian era, there was a disposition to blame either the military administration for delay in collecting the wounded, or the surgeons near the front for inefficient methods of treatment. Whatever the cause, these disabilities have disappeared. They were due in reality to the first shock of the war falling upon a peaceable people, but the position in the beginning was not at all clear. Both the causes suggested probably had their effect, but a broader inspection of the facts showed that another influence was at work more potent than either of the other two. A problem cannot be solved until it has been fully stated, and only when this stage had been reached could this problem be fully stated. It was then seen that the attempt to solve it must include administrative measures, novel clinical action, and bacteriological investigation. Investigation showed that the severe wound infections were due to anaërobic organisms derived from the heavy manuring of the soil which is an essential part of intensive cultivation. The articles in Chapter VI by the consulting surgeons, the clinical surgeons, and the bacteriologists, describe how they worked together in tackling the terrible problem of gas gangrene. Others are afforded in Chapter VII, in which Surgeon-General Sir George Makins gives an account of the developments of British surgery in the hospitals on the lines of communication in France.

Other examples of co-operative inquiry at the bedside and in the laboratory leading to improved administrative action for prevention of disease and infection and their better treatment are afforded in Chapters X and XII, in which Sir John Rose Bradford discusses gunshot injuries of the chest, and Sir Bertrand Dawson that strangest malady of all—infective jaundice.

In Chapter II Professor Andrewes sketches the means taken to organize research into the cause, mode of dissemination, and treatment of the dysenteries, of bilharziasis, and of cerebro-spinal fever, and into the mode of dissemination of the various types of the enteric group of diseases, and the use of mixed vaccines for their prevention. He gives a summary of the long series of researches into the bacterial causes of wound infections, and of the principles of the various methods devised to counteract them. In Chapter IV Dr. H. D. Dakin discusses the relation of biochemistry to war problems, dealing particularly with the chemistry of disinfection and the value of chlorine disinfectants, in the investigation of which he has taken a large part. Since the chapter was written he has proceeded further, and, working with Major E. K. Dunham, of the United States Army Medical Service, has introduced certain chloramines which possess high disinfecting powers, while their unirritating character renders them specially suitable for the treatment of wounds.

Many problems had been foreseen, and had been successfully studied by the pathologists of the Army Medical Service, but a succession of others were rapidly presented, some of them new, others old but under new aspects. For all it was of the utmost importance quickly to find solutions. It would have been interesting, had space permitted, to have given a full account of the organization of the intensive combined researches instituted. Only incidental references to this will be found in the following pages, and it must suffice here to say that it consisted of mobile laboratories not far behind the front—mobile in the sense that the whole equipment could be carried in a motor van, although usually the director transferred his apparatus to an improvised laboratory in a permanent building—of clinical laboratories attached to hospitals, and of research laboratories at the bases abroad and at home. The problems came thick and fast from the hospitals, and admirable as has been the work done in the field laboratories, it was necessarily of a pioneering kind, the main attack requiring larger forces and equipment than they possessed. The laboratories and staffs of the Army Medical Service at home are fully occupied in routine work and in the study of certain special problems of which the prevention and treatment of tetanus, and precautions against the effects of poisonous drift and shell gases, only need be mentioned.

It was fortunate that there had then recently come into existence a body with considerable financial resources designed to organize and direct collective research on a large scale. By a short clause in the Insurance Act of 1911 Parliament undertook to provide annually a sum of between fifty and sixty thousand pounds for the advancement of medical knowledge, and in 1913 a committee of experts was appointed to draw up and administer schemes of research. In this committee—the Medical Research Committee—the country had a disinterested body of experts charged with the duty of expending public funds on medical investigations, possessing a staff of laboratory workers already organized, and commanding the services of a secretary who had previously won high reputation as an independent investigator, and who, in this emergency, has shown eminent capacity in directing inquiries into the large and complicated problems that have arisen.

This Committee was able at the beginning of the war to turn aside from the schemes it had formulated and at once to institute comprehensive researches into the new problems affecting the military forces into which so large a portion of the manhood of the nation had been recruited. It is perhaps not too much to say that by the initiation of many organized inquiries in the earliest months of the war the Committee succeeded, directly and indirectly, in creating an atmosphere in which, as in no previous campaign, there has grown up an emulation, especially well marked among the younger workers, to improve the knowledge by which military medical work must be guided. The natural tendency in time of war is to assume that research must stand still while existing knowledge is applied to the immediate task of defeating the enemy. Looking back now upon three years of war in which the whole activities of the nation have been mobilized we can see how effective from a purely military point of view have been many of the advances in knowledge secured under war conditions. It is such advances of knowledge that stand out among the wastage of war as benefits of permanent value for the future.

Two other phases of the work of the Medical Research Committee are likely to make the medical history of the present war especially noteworthy. From the beginning the Committee has undertaken for the Army Council the compilation of the medical and surgical statistics of the war from the books of all hospital units at home and abroad, and in supplement to this has arranged for the classification and indexing of the "medical case-sheets" of all sick and wounded. Scientific methods only recently developed have been applied to the collection and analysis of the medical statistics. It will take many years to finish this work, but the complete Card Index of all sickness and casualties which is now being formed, as a preliminary to the future use of modern methods of sorting and analysis, will remain after the completion of military medical statistics an invaluable reference index for the checking of those claims upon the State which must be expected, during this and the next generation, in respect of future disability alleged to be the secondary result of war service.

A special characteristic of this war, novel in the experience of the British Army Medical Service, is that the nearness of the chief fighting area and modern methods of rapid transport have made it possible quickly to transfer wounded from the front to home hospitals by ambulance trains and by hospital ships on the narrow seas. These conditions have combined to bring about, speaking generally, the concentration in France of early medical and surgical treatment and of later treatment in hospitals in the United Kingdom. An official mechanism was needed to link up these two stages of treatment. Workers in France urgently needed the knowledge to be derived from the prompt collection and examination of the later results of the methods of treatment they were following, for without it they could not improve them in the light of experience. At the same time medical officers at home were handicapped by lack of knowledge of previous stages of treatment. The Medical Research Committee has been able, with the sanction and support of medical head quarters, to do much towards filling up of this gap. The after-histories of cases first treated in France are collected in groups, according to official request, by means of a post-card and schedule system, and the results so collected are supplemented by reports made from time to time upon the basis of the classified medical case-sheets in charge of the Committee. By these collections and reports, and their transmission to France, precise knowledge has become available there of the later results of treatment as reflected in the subsequent hospital history in this country of many groups of cases, as, for example, wounds of the abdomen and chest, amputations, knee-joint injuries, and nephritis.

Information of the greatest practical value for the guidance of treatment has also been obtained by quite a different method, namely, the segregation in this country of particular groups of cases for intensive study. The first example was the assignment of neurological cases to specialists and the establishment of institutions organized for the treatment of the manifold forms of functional nervous disorders produced by the shocks and strain of war. A system of labels provided, with official sanction, by the Committee was introduced to ensure that such cases should be sent to the special institutions, and with it was coupled a mechanism for the interchange of information between medical officers responsible for the early treatment abroad and for the later home treatment. Other groups of cases segregated for particular inquiries, at the instance of the Committee, have been those of nephritis, certain gassed cases, cases of malaria, and men suffering from disordered action of the heart. In Chapter IX Sir Clifford Allbutt, Regius Professor of Medicine in the University of Cambridge, in discussing the investigation of the significance of disorders and diseases of the heart in soldiers, founds himself on the report made by Dr. T. Lewis to the Medical Research Committee, with regard to the work done at the special hospital for such cases established at Hampstead. In this hospital scientific investigations are being pursued which not only have at once led to important changes in treatment and a great reduction in the average duration of the stay in hospital of these cases, but will be of permanent value to civil medicine. The principle of specialization for particular purposes has now won its way. Besides its value in allowing the rapid collection of information, it has been found in suitable cases to encourage increased energy and efficiency in treatment.

It has, with one exception, been possible to make only incidental references to the elaborate organization built up for the treatment of the disabled soldier returned to the British Isles or to his overseas home. The success attained has not been equalled or even approached in any previous war. The Territorial and other general military hospitals, originally planned each to provide beds for 520 patients, have been greatly extended, auxiliary military hospitals and convalescent homes have been set up throughout the length and breadth of the countries, and many camps for physical reconstitution and training established. Special institutions have been organized for the training of men who have lost sight or hearing as the result of wounds. All this organization has been brought into existence in order that the disabled soldier shall be helped to help himself.

The great importance of military orthopaedic surgery—the surgery of disabilities and deformities of limbs resulting from war wounds—justifies the inclusion of a separate chapter on this subject. In it Dr. Colin Mackenzie, an Australian surgeon and anatomist, discusses the object and the methods of orthopaedics, and shows how principles evolved by the labours of many surgeons, particularly in this country and America, for the rectification of congenital or acquired deformities in children have been applied for the benefit of the crippled soldier. In the second part of this chapter he describes the military orthopaedic hospitals and auxiliary institutions already at work. Large as is the organization he depicts, it is being continually extended, and must continue to grow until peace is restored. One of the difficulties encountered is to find an adequate number of surgeons possessed of the special experience and skill required. It is a gratifying instance of international comity that when in this difficulty Sir Robert Jones, the British Inspector of Military Orthopaedics, appealed to the orthopaedic surgeons of the United States to come over and help us, they organized within a fortnight a body of twenty-two experts, who at once came to England, and, with the sanction of the United States Government, placed themselves unreservedly at his disposal to do duty in British military orthopaedic hospitals. Hospitals have been set up also in England, Wales, and Scotland where men who have lost an arm or a leg are fitted with artificial limbs made in the hospital workshop. These are permanent institutions, and to them the men will be able to return at any time during their lives, should their artificial limbs cease to fit well or wear out.

British medicine by an appeal to results is justified before the nation. It has yielded an army free from sickness. To the wounded it has brought instant and sustained relief. The guiding principle through which it has achieved this end in military surgery, medicine, and hygiene is disclosed in these pages. The principle is not new, but it can never grow old, for it is "ever to search out and study the secrets of Nature by way of experiment."

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CHAPTER I.

THE INSTITUTES OF SURGERY: AN HISTORICAL REVIEW.

BY

SIR BERKELEY MOYNIHAN, C.B., M.S., F.R.C.S.,

PROFESSOR OF CLINICAL SURGERY IN THE UNIVERSITY OF LEEDS; TEMPORARY LIEUTENANT-COLONEL R.A.M.C.

MEN, it is said, are apt to be taken at their own valuation. What is true of a man may be true of a nation. It is beyond dispute that Germany, as a result, in part, of the arrogant repetition of her claim to intellectual superiority over all nations, and in part, of a tolerant and sometimes disdainful silence or acquiescence by others, has been accepted almost universally as the pivot and centre of the world's thought. My own realization of this, in regard to surgical matters, was dramatic in its suddenness. I had been a student in Germany years ago, had lived with German students, and followed closely the work of German surgeons in several clinics. I had formed my own conclusions as to the value of the German contributions to surgical advancement, and nothing that has happened since the war began has altered in any way the opinions I then held. About five years ago one of the most distinguished of the Scandinavian surgeons, who had made a yearly pilgrimage to Germany of some weeks' duration, came to spend his surgical holiday in England. He lived with me for more than a month. I had always known him as a warm advocate of Germany's methods in surgical literature and practice, and of his intellectual contempt for most of the things which other nations had done. Of the work of these other nations he had learnt nothing at first hand; the little he knew had been distilled through the minds of German interpreters, and had been conveyed to him verbally on his frequent visits, or had been taken from the easily accessible German journals and textbooks. At our first breakfast meeting he told me of his immense obligations to Germany, of his schooling in her methods, of his devoted attention to the debates of the German Surgical Association; and he went on to say that he felt it almost an act of treachery to spend his surgical vacation in any other land. And then he gravely announced that "Of course all surgical advance in the last fifty years has come from Germany." To that kind of fervid unrestrained assertion the most fruitful denial is given by a questioning assent. I answered: "Of course; tell me of one." Whereupon I had to learn from him that the introduction of the antiseptic system into practice was wholly to be attributed to German research, adoption, and advocacy. Now this claim so confidently made, and, I hope I may say, so utterly shattered in the debate which followed, is precisely the type of claim which Germany herself has always made. Most of the great ideas, she tells us, originated with her; those that by chance arose elsewhere would never have come to fruition but for her acceptance, and for the authority with which thereby they were endorsed.

ANTISEPTICS.

Of the facts as to the discovery of the antiseptic system there is, of course, no dispute. They begin with the discovery in 1836 by Latour of the living character of the yeast cells by which fermentation was produced. This discovery, it is interesting to recall, was denied both by Liebig and by Helmholtz. The confirmation and extension of this work by Pasteur in 1856 showed that putrefaction and fermentation were the result of living particles, and that for each type of fermentation a specific particle was necessary. "The most far-reaching of my researches," said Pasteur, "is simple enough; it is that putrefaction is produced by living ferments." He asserted that the oxygen of the air was not the cause of putrefaction, as every one hitherto had supposed; that, indeed, some of the causes of decomposition could thrive only in the absence of oxygen. This observation, too, which distinguishes "aërobic" from "anaërobic" organisms, is of the first importance. It was these discoveries which suggested to Lister the thought that the putrefactive changes in wound discharges might be due to living organisms, and that the exclusion of these would enable wounds to heal without the formation and corruption of purulent discharges.

In 1867 Lister wrote: "When it had been shown by the researches of Pasteur that the septic property of the atmosphere depended, not on the oxygen or any gaseous constituent, but on the minute organisms suspended in it which owed their energy to their vitality, it occurred to me that decomposition in the injured part might be avoided, without excluding the air, by applying as a dressing some material capable of destroying the life of the floating particles."

A discovery is rarely the work of one mind. It is one observation added to another that makes the supersaturated solution from which the crystal of truth at last precipitates. Lister never ceased to give credit to Pasteur for his share in the work that led finally to the development of the antiseptic method. The exploratory work, the pioneer work, all that was original, was done therefore by a French observer and an English surgeon. The exploitation of this work, it is true, was almost at once eagerly and widely carried out by the surgeons of Germany. The system was examined, appraised, and adopted throughout the whole empire of Germany; but so it was elsewhere. Lister never had a more ardent, a more scrupulous and conscientious pupil than Lucas-Championnière. Up to his death this veteran French surgeon carried out with meticulous care exactly those procedures which he had learnt from Lister. But the loud shouting in support of the antiseptic treatment came chiefly from Germany. When in 1875 Lister visited that country his progress was a triumph. It is notorious, however, that in carrying the Listerian principles to their logical conclusion in practice, Germany fell far behind other countries. In recent times has any surgeon visited Germany to learn a good technique? Is it not true to say that those surgeons of whom one heard most in the world, great teachers and writers as they doubtless were, were lacking in the very rudiments of a sound and careful method? There was not, I truthfully believe, one surgeon in the whole German empire who looked upon an operation as an experiment in bacteriology, and who to avoid infection in his wounds used scrupulous care in the preparation and manipulation of his instruments and materials, who avoided chance contamination, and who used extreme gentleness and delicacy of touch as modes of avoiding that form of trauma which makes infection easy. And the average display of a technique called aseptic or antiseptic was something immeasurably below the standard of some surgeons in England and of many in America. Even in the method they so ardently exploited, and in a field they claimed as their own, they fell far short of the best. This example is typical of many. All modern surgery, as we know, dates from Lister. The difference between the surgery of ancient days and the surgery we practise to-day is expressed in one word, "Lister."

Of all the advances made in surgery the most fruitful and the most interesting is that which depends upon a study of the "pathology of the living." Lister made it possible to operate with safety upon conditions which threatened life, or made it almost unendurable—such, for example, as ovarian cyst. And by degrees, as methods were perfected and experience widened, other diseases could be attacked, at first in their terminal or more dramatic manifestations, as in the perforation of gastric or duodenal ulcers; and later in their pathological career as disturbers of function or of health, before the later complications had had time to develop. It is interesting to note that the first surgical attack upon many diseases afflicting the abdominal viscera has been made when terminal events have rudely developed, and when therefore the surgical hazards were greatest. It was only in later days that the deliberate operations for initial stages of the same disease were brought within the province of the surgeon.

The Appeal to Nature.

When we review the wonderful and varied achievements of medicine it is not easy to fix a time at which the science and the art of surgery, as we think of them to-day, began to develop. As we look back we realize that it is because of the work of Vesalius the anatomist, of Harvey the physiologist, of Morgagni the father of pathology, and later of John Hunter, the first of scientific surgeons, that all subsequent advances were made possible. From the rude efforts of the early and mediaeval surgeons the first real step forward was made by Ambroise Paré, who stands conspicuous above all his contemporaries at the time of the Renaissance. Between Paré and Hunter probably only one surgeon was of serious consequence in the progress of our art. This was Richard Wiseman, a man "given to the observation of nature," who was the first to advocate and practise primary major amputations. Till the days of Hunter surgery produced, it is true, great or successful individual practitioners, but there was little or no progress in the scientific work upon which the craft must always be based.

It was Hunter in England, and Bichat in France, who went to original sources for their knowledge. Hunter wrote of himself, "I am not a reader of books," and "I believe nothing I have not seen and observed myself." His prodigious industry, his intellectual rapacity, his vast store of first-hand observation, and his simple attitude as a student all his life, are not equalled in the history of Medicine. Harvey had said of himself that he felt it in some sort criminal to call in question doctrines that had descended through a long succession of ages and carried the authority of the ancients, but he "appealed unto Nature, that bowed to no antiquity, and was of still higher authority than the ancients." With Hunter it was quite different. His eager inquiry was always for the story as it was written by disease upon the tissues of the dead body. His information was always first hand, gleaned from every source, with unwearying patience and untiring zeal. His disregard of written words and of ancient authors was deplorable no doubt, but a striking and authentic characteristic nevertheless. His reply, when taunted with ignorance of the classics, is famous: "Jesse Foot accuses me of not understanding the dead languages, but I could teach him that on the dead body which he never knew in any language, dead or living." He was the born collector, possessed of an insatiable appetite for knowing rather than wondering, and for seeing rather than reading or hearing of another's work. No man ever suffered less from the tyranny of the written word; no man ever searched more diligently or in humbler mood for those eternal sources of the truth upon which alone a science of medicine can be founded, and from which alone it can be continually refreshed. Hunter realized, as Paré and Franco before him had done, as every great original thinker since has done, that the foundations of true progress in scientific work are laid deep, that it is "from the depths, not from the heights, that medicine is fed; from the springs, not from the sky." The impetus and the authority given to surgical work by the researches of Morgagni, of Bichat and of Hunter were incalculable. The time was gone for ever when a pure and dangerous empiricism could be practised; surgery became a rational procedure, and its new ventures were held in restraint, as we now realize, only by the fear, or rather the certainty, of inflammatory complications more immediately dangerous than the disease from which relief was sought.

For the groundwork of medicine and of surgery, therefore, Germany was in no degree responsible. It was Vesalius of Brussels who laid solid the foundation of anatomy, in a treatise remarkable alike for the accuracy of the descriptions and for the beauty of the illustrations, which came perhaps from the studio of Titian. It was Harvey, our own countryman, who, by his immortal discovery, swept away the decaying fragments of Galenism, and made possible all later researches in physiology. It was Morgagni, the Italian, who brought together the statics and dynamics of medicine, who founded pathology, the science of the causes of error in the working of the human machine, and who explained symptoms by assigning them to structural alterations in the several organs of the body. It was Hunter who changed surgery from a handicraft to an art based upon an accurate knowledge of diseased tissues, who first made of surgery a science. It was Pasteur, the Frenchman, who guided Lister to his discovery of antiseptic surgery, which has changed the whole history of our science and craft. It was Morton and Warren of Boston, and Simpson of Edinburgh, who, by the discovery of ether and of chloroform, robbed surgery of its agony and horror and made it accessible as well as possible. To all these weighty matters, to all the indispensable achievements without which medicine could have made no advance, it is the simple truth to say that Germany gave nothing.

Abdominal Surgery.

The first great surgical adventure of modern times was concerned with the removal of ovarian cysts. The history of ovariotomy is well known, but will bear at this moment a brief repetition. Removal of the ovaries in animals and in aborigines has been practised from prehistoric times. In the literature of the middle ages several curt references were made to "dropsical ovaries"; and opinions were expressed that operative measures might sometimes be undertaken with a remote chance of cure. The first successful case was operated upon in 1701 by Houston of Glasgow the patient lived till 1717. John Hunter wrote in 1785: "I cannot see any reason why, when the disease can be ascertained in an early stage, we should not make an opening into the abdomen and extract the cyst itself." Before this William Hunter had written, in 1762: "It has been proposed by modern surgeons, deservedly of the first reputation, to attempt a radical cure by incision or suppuration, or by excision of the cyst." The first surgeon, however, to whom the world's credit and applause are due for establishing the operation as a proper and safe procedure was McDowell of Kentucky, an old pupil of John Bell in Edinburgh, by whose teaching he was inspired. McDowell's first case was operated upon in 1809; the patient lived till 1814. Between 1809 and his death in 1830 McDowell operated upon ovarian tumours in thirteen cases, and it is known that eight patients recovered. After his day the operation fell into disrepute, and the failures were so many that Baker Brown abandoned the operation, saying: "It was of no use, peritonitis would always beat one." It was after his return from the Crimea that Spencer Wells, an old pupil of the Leeds Infirmary, upon his appointment to the Samaritan Hospital, began, in 1858, that series of operations which firmly established the surgical treatment of ovarian tumours in favour, and by its success, and by the influence it had upon the treatment of other intraperitoneal conditions, opened up the whole field of abdominal surgery. The opposition to the surgical treatment of ovarian cysts was, as is well known, of the most bitter and inveterate kind, but Spencer Wells, by his simplicity of character, his unwavering integrity, and his sweet reasonableness in argument, wore down all antagonism. In the year 1880—that is, in twenty-two years—he had operated upon 1,000 cases, of which 768 recovered. During the first five years one patient died in every three operations; in the last two years one patient died in every ten. Writing in 1882 Spencer Wells said, "In Germany until quite recently ovariotomy was scarcely talked or thought of." Billroth, in a lecture on ovariotomy, said of Spencer Wells, "I shall willingly regard myself during my lifetime as his scholar." It is astonishing to recall that Spencer Wells's early success was achieved before the introduction of antiseptic surgery. In the edition of his work on *Ovarian and Uterine Tumours*, published in 1882, he endeavours to estimate the difference in the mortality and morbidity of his cases as a result of the introduction of Lister's methods. It is therefore true to say that the whole of the immense progress that abdominal surgery and internal medicine have made in the last thirty years has been due to the impulse and the investigations of these two English surgeons, Spencer Wells and Lister. In all the pioneer work which made possible the infinite achievements of modern abdominal surgery, the contribution of Germany was precisely nothing. What part has she played in the later progress?

Let us take for a first inquiry the surgery of the gall bladder. The fullest account of the history of this extraordinarily interesting adventure in surgery is given by many German authors, of whom Langenbuch is, perhaps, the chief. On page after page of the story as told by him reference is made to the priority of German surgeons, and pride in German achievements is openly and frequently expressed. A chapter of this author does duty not only as a contribution to the history of surgery but as a political pamphlet also. And, like much in the literature of politics, it is found on close examination to be acutely controversial, when it is not false. What are the facts? The first attempt to deal surgically with the gall bladder was made experimentally by Zambeccari in 1630. This observer ligatured the cystic artery and duct in a dog and removed the gall bladder. Two months later the dog was killed, and to the ligatured stump omentum and small intestine were found adherent. To Jean Louis Petit in 1743 is to be attributed the first suggestion of the surgical treatment of a distended gall bladder, and the first considered attempt to deal operatively with it during the life of the patient. Over a century later, in 1859, Thudichum, in a paper on the "Pathology and treatment of gall stones," wrote: "In decided cases the surgeon should consider the propriety of planning and performing an operation for the extraction of these foreign bodies either in a direct manner or by forming a biliary fistula and adopting a lithotriptic proceeding." In 1876 Thudichum and Maunder again broached the subject, and in 1878 Handfield Jones also proposed operation to a patient suffering from cholelithiasis. In the year 1867 an American surgeon, Dr. Bobbs, operated upon a case of abdominal tumour, diagnosed as probably one of ovarian cyst. The tumour proved to be a gall bladder, upon which Bobbs performed "lithotomy," removing several stones. But it is to Marion Sims that the credit is to be given for the first formulation of the operation of cholecystotomy; the deliberate planning and the practical accomplishment of a procedure so carefully designed and so thorough that Lawson Tait wrote, "The entire possibilities of the treatment of gall stones and distended gall bladder are exhausted in Dr. Marion Sims's original paper."

The first operation successfully performed in two stages is to be credited to Kocher, who in 1878 opened the abdomen, packed round the gall bladder with Lister's gauze, and six days later, when a barrier of adhesions had formed, opened the gall bladder and emptied it of stones.

An examination of all the lengthy literature of this subject, however, leaves one in no doubt that the most conspicuous merit for the pioneer work attaches to Lawson Tait. It was he who, basing his work upon the case of Marion Sims (a case of common duct obstruction, with jaundice, which proved fatal in a few days from haemorrhage), made of cholecystotomy a safe operation. Probably no operation of equal difficulty and severity was ever ushered into the world with so marvellous a series of successful cases. In 1884 Tait wrote: "I have performed the operation thirteen times, and all recovered." Up to the end of 1884 there had been performed in all the world twenty-eight operations, of which Lawson Tait did thirteen. Of the first 104 cases, he had operated upon 56; the whole of Germany then claimed 9 cases.

Cholecystectomy, the safe possibility of which had been shown experimentally two and a half centuries before, was first performed on July 15th, 1882, by Langenbuch. This is a very valuable addition to the resources of the surgeon and its originator may well have had a legitimate pride in its inauguration. We cannot, however, hope to pay to his memory the luscious compliment he paid himself in the arrogant Prussian fashion and at inordinate length. If it is the only original contribution of Germany to the surgery of the biliary system, it is in truth a considerable one.

In the later developments France, England, and America may claim that they have played the greater part. To them are due not only those advances along the frontier of medicine which have disclosed to us the early symptoms of cholelithiasis, but also those technical perfections which have made precocious interference the safest and most prudent of all modes of treatment. Over against this recent work what has Germany to show? She has one man of large experience to put forward—Kehr, and he is, indeed, a typical representative of his country. Kehr has been a prolific writer and has published very full accounts of his technique and results. Kehr advises operation where there is obstruction of the cystic duct, infection of the gall bladder or ducts, or when stones are arrested in the common bile duct. A great many of the indications accepted by surgeons in other countries are omitted. For the purpose of access to the parts he has devised an incision, the *Wellenschnitt;* of great length, it begins in the epigastrium below the ensiform cartilage, extends downwards towards the umbilicus, then across the right rectus transversely for 2 in., and, finally, vertically down the rectus for 3 in. to 4 in. A very free exposure results. In all cases, or almost all, the gall bladder is removed, and the hepatic duct drained, often by a tube of T-shape, one arm of which goes upwards to the liver, the other downwards to the duodenum. The methods throughout are crude, coarse, heavy-handed, lacking everything in the way of daintiness and refinement. This is expressed in the results, in which the mortality and morbidity are excessive. So far as the purely intellectual side of the work is concerned, in all Kehr's writings there is nothing at first hand. The inquiry as to the inaugural symptoms of cholelithiasis, the question of the early recognition of the presence of stones, the association of gall stones with other abdominal diseases, appendicitis, intestinal stasis, in the relation of effect and cause—of these matters there is rarely an original observation. There is the same academic completeness of exposition which we find in all German work; full, indeed tedious, accounts of anything and everything, wearisome prolixity; but the facts and records are there in full. The only original piece of work done in the whole realm of cholelithiasis, in recent years in Germany, is that upon the formation of gall stones, by Aschoff and Bacmeister; it is important and accurate, but it touches only the fringe of the larger question of cholesterinaemia, in which the chief work has been done by the French.

What is the history of the surgery of the stomach? The earliest account of gastric ulcer was given by Matthew Baillie in 1798. It is true that the disease is mentioned both by Galen and Celsus, and that there are records of probable cases, when haemorrhage or perforation occurred or fistula into the stomach developed, as early as the sixteenth century. But the first clear and illustrated anatomical description, accompanied by clinical histories, was given by Baillie. It is, however, to Cruveilhier, who wrote in 1829 and 1830, and up to the year 1838, that we give credit for the first full and accurate descriptions of the pathology and clinical manifestations and treatment of this disease. These descriptions are in the tenth and twentieth parts of his splendidly illustrated work on pathological anatomy. To Cruveilhier the famous German physician Ewald attributed the first careful and comprehensive description of gastric ulcer, and said that he "was the first to raise the gastric ulcer from a curiosity of the autopsy table to the dignity of a definite and recognizable pathological condition." In the year 1835 Cruveilhier gave the first suggestion of the development of cancer from a simple ulcer.

The earliest records of duodenal ulcer are found in connexion with stray cases, or in those where perforation or haemorrhage had occurred and caused death. The earliest mention was by Travers in 1817. Abercrombie in 1830 gave the first connected account of the disease, and recorded a few cases. In 1894 the first successful case of operation for a perforated ulcer was recorded by H. P. Dean of London. In 1900 Weir of New York gave an excellent summary of all the cases of perforation then on record. But of duodenal ulcer as a cause of continued or recurrent dyspepsia, or as a pathological lesion to which were attached a series of symptoms capable of recognition during life, there is nothing. The first ascription of a group of symptoms to the definite structural lesion in the duodenum is to be placed to the exclusive credit of English medicine.

The development of the surgery of the stomach has been one of the most brilliant and most fascinating of all the recent conquests of our art. So long ago as 1810 it had been shown by Merrem that the removal of a part of the stomach in dogs could be followed by recovery. This experiment was repeated and multiplied in 1876 by Gussenbauer and Winiwarter. It is, however, to a French surgeon, a most dexterous operator, that the credit is due for the first attempt, albeit unsuccessful, to remove a part of the stomach for cancer. On April 9th, 1879, Péan of Paris carried out the first pylorectomy for malignant disease. The operation was repeated, again with a fatal result, by Rydygier in 1880. It was on February 8th, 1881, that Billroth in Vienna performed the first successful gastric resection for carcinoma. I have seen the specimen, which consists of the pyloric end of the stomach; it measures about 3 in. in length in its present state. It was the work of Billroth and of his assistants Mikulicz and Wölfler that proved the surgical treatment of carcinoma of the stomach to be feasible. Billroth clearly laid down the principles and the technical details to be observed in all gastric operations. All later work was made possible by his work, and we may safely reckon his contribution to this branch of surgery as the finest of the many notable achievements in the life of this great surgeon. It fell to Wölfler, while assistant to Billroth, to perform the first operation of gastro enterostomy, on September 27th, 1881. The patient suffered from a malignant obstruction of the pylorus, and it was Wölfler's intention to perform resection. This was found impossible, and the abdomen was about to be closed when Nicoladoni, who was assisting, suggested that the jejunum should be united to the stomach and an opening between the two viscera made to relieve the pyloric obstruction caused by the growth. The original operation was of the "anterior" type. Union of the jejunum into the posterior surfaces of the stomach was first suggested by Courvoisier of Basle, and von Hacker of Innsbruck.

The great surgical accomplishments in the last quarter of a century have been concerned with the simple diseases of the stomach, with chronic ulcer and its complications. The first gastro-enterostomy for chronic obstructive ulcer was performed in 1892 by Doyen of Paris. It is to the advocacy and to the marvellous technical skill of this surgeon that we must attribute the general recognition of the value of surgical measures in cases of chronic gastric disease and the recognition of gastro-enterostomy as a "drainage operation." The surgery of perforating ulcer of the stomach began with Mikulicz, whose first suggestion dates from 1880. Between the years 1885 and 1893 Mikulicz operated upon thirty-five cases with thirty-four deaths. This is to be considered, taking into account the early period of this work, as the saving of one life, rather than the loss of many.

The literature emitted by Germany upon the subject of gastric diseases is vast in quantity, prolix and turgid in style, lacking insight and interest, and almost utterly devoid of inspiration or original thought. It is, however, a complete record of the progress made and of the knowledge gained by all the workers in every corner of the field. The Germans are seen in their most characteristic phase as gleaners and harvesters. The seed has been sown by others; it is they who have guarded the crop, garnered it, gleaned every straw of it, and stored it in vast and ugly chambers. Gastric ulcer is a comparatively rare disease, of few but clear-cut symptoms. Around this simple matter the German clinicians have weaved a web of rhetoric which has encumbered it and swathed it beyond recognition. And they have borrowed freely from a riotous but rank imagination bereft of facts, and have insulted the intelligence of those who could not agree with them. The literature of Germany on such a subject as gastric ulcer reminds me irresistibly of Hans Andersen's delightful story of the "Emperor's New Clothes." Around this simple disease their physicians weaved, with unceasing industry, garments of a material every thread of which they declared to be of the rarest and finest quality, they told all the world of the beauty and superb texture of these royal robes; so confident and magisterial were their loud assertions and so complete the trickery by which they imposed upon all spectators, saying that only those of virtue could see the wonderful garments, that, as in the story, the crowd was humbly acquiescent. But at last the little child, the surgeon, came along and cried: "But he has got nothing on." And the whole artificial fabric was torn away, and the imperial ulcer was seen for what it was in all its naked ugliness.

SURGERY OF THE BRAIN AND CORD.

The development and progress of cerebral surgery in the last century would certainly be considered by the older physicians, could they learn of it, as the most incredible achievement of all. To them the skull and its contents were sacred and inviolable. Aristotle had spoken disparagingly of the brain, saying it was a mere cooling apparatus, and trephining operations had been not uncommon even in prehistoric times. But by the mediaeval physicians the brain was looked upon as the seat of the soul, and no profane hand might be laid upon it. When, however, the Renaissance came, with its astonishing development of physical science as well as of art, the work of Mondinus and Vesalius opened the path for all later explorers. What Harvey achieved for physiology was almost equalled by the work of Thomas Willis on the nervous system. As Victor Horsley said, these researches "exhibit an extraordinary grasp of the function (and its corresponding relation to structure) of the nervous system generally." Willis's work ought to have abolished for ever the old mystical beliefs as to the function of the brain. He was the first to allocate definite functions to distinct parts of the nervous system and to assert that the excitation of the cerebral cortex passed into the substance of the brain and thence into the spinal cord and nerves. The work of Thomas Willis was, unhappily, ignored completely, though as we look back upon it we are inclined to agree with Horsley, who wrote "that it was due to Willis that probably the greatest advance gained in psychology ever since it became a science, the localization of function to distinct parts of the nervous system," was made. The first of those who sought by the method of experimental research to discover the secret of the functions of the brain was Flourens in 1826. His investigations dealt both with the cerebrum and the cerebellum, and were of high value, not only as examples of a new method, but also because of the positive, though limited, conclusions upon many matters, which as a result of his work he was entitled to draw. But even he, writing more than a century and a half after Willis, asserted that the brain worked as a whole, and that separate specific functions could not be allotted to its several constituent parts. Indeed, the universally accepted opinion up to the year 1861 was that the brain acted as other organs acted, its function being carried out by an equal working of all its parts. In this year Broca, as the result of his inquiries into the pathological anatomy of certain cases of aphasia, came to the conclusion that the faculty of articulate speech depended upon the integrity of a definite and limited area of the cerebral cortex. Broca's discovery was revolutionary; it involved a complete reversal of former opinions and judgements, and it opened up afresh the whole question of the function of the cortex of the brain. Hughlings Jackson in 1869 was the first to assert that the convolutions of the brain could be divided up into separate areas, each having its own restricted and unchangeable function. He based his opinion upon observations made to correlate the clinical symptoms manifested during the life of the patient with the organic lesions of the brain discovered after death. In 1870 Fritsch and Hitzig demonstrated by animal experiments that by the electrical stimulation of certain areas upon the cortex co-ordinated movements, in distinct groups of muscles, on the opposite side of the body, could be produced. These observations were important, but the work of supreme significance in cerebral localization was done by Ferrier, and published in 1873. Ferrier's researches were undertaken to test experimentally the conclusions reached upon clinical and pathological grounds by Hughlings Jackson. The result is known to all the world. Ferrier's investigations established firmly and finally the knowledge that there are points in the cortical matter of the brain definitely related to the motor and sensory functions of certain parts of the body. The way now was cleared for the surgeons, for Lister had afforded them safety, and Hughlings Jackson and Ferrier gave them guidance. The pioneer work in this direction was exclusively of British origin. One of the most dramatic occurrences in the whole history of surgery must surely have been the reading on August 9th, 1888, of a paper on the "Surgery of the brain and spinal cord" by W. Macewen of Glasgow. Cerebral surgery seemed to spring Minerva-like into the world, complete at every point. Macewen told of his first case in July, 1876; it occurred in a boy who developed an abscess in the immediate vicinity of Broca's lobe, as the result of an injury to the skull. Consent was not given to the operation urged by Macewen, notwithstanding the assumption by himself of the sole responsibility of advising and performing the operation; and the boy died. Macewen tells how "after death the friends acquiesced in the proposal to have the operation performed just as it would have been had permission to do so been granted during life. The skull was trephined, the brain exposed, and an instrument was introduced through the third frontal convolution for half an inch, when pus flowed through the incision, proving the accuracy of the diagnosis and giving poignancy to the regret that the operation had not been permitted during life. The abscess, about the size of a pigeon's egg, was situated in the white matter of the bases of the second and third frontal convolutions." In this case the precise spot in the brain which the abscess occupied was accurately determined from the localizing phenomena induced by the focal lesion.

Macewen's first successful cases—one of abscess and one of tumour of the frontal lobe—occurred in 1879. In the paper to which I have referred there were recorded 21 cerebral cases (exclusive of fracture of the skull with brain lesions), with 18 recoveries and 3 deaths. Of those who died all were *in extremis* when operated upon. At the time the paper was read 16 of the 18 were still alive; one had died eight years after operation, and one forty-seven days after operation of tuberculous enteritis.

The record of the work achieved by this surgeon, working alone upon new problems and in a new field long before other minds had begun to stir, is one of the greatest triumphs in the history of scientific surgery. In the year 1884 Bennett and Godlee reported a case of cerebral tumour treated by operation, and in 1886 Victor Horsley reported three cases of cerebral surgery to the British Medical Association.

Great Britain may therefore make an undeniable claim to priority in respect both of the scientific work which made operation upon the brain possible and purposeful and of the procedures by which such operations were carried out with safety and accuracy. Germany here also has been a follower, not a founder. Her entrance into this field was of later date than that of the British, French, and Italian physicians and surgeons, but her work in it has been arduous and helpful.

The development of the surgery of the spinal cord was also dependent upon early experimental research. Galen, as is well known, had shown that there must be nerves of sensation and nerves of motion. Willis had made it certain that the nerves did convey sensation "and instincts to movements," but, as Sir Victor Horsley says, "no further determination as to the particular part of the nervous system which might be occupied in providing for such transmission of sensations and movements was made until 1811, when Sir Charles Bell, by his numerous investigations, was led to believe that separate parts of the brain and spinal cord subserved these two functions." Sir Charles Bell knew, of course, that the spinal nerve had two roots, anterior and posterior; he found by experiments that it was irritation of the anterior roots only that gave rise to the movements of the muscles. He says: "I now saw the meaning of the double connexion of the nerves with the spinal marrow." Bell's work was the first to prove that there was undoubtedly a principle of localization of function in the nervous system. When it had once been shown that this localization of function existed in the conducting nerve channels it was not difficult to see that the same difference must exist in those central parts to which, and from which, the nerves must pass. The surgery of the spinal canal was inaugurated by Sir Victor Horsley, who in 1887 was the first to open the spinal dura mater and to remove a tumour of the cord. In December, 1888, Bennett first divided the posterior nerve roots in a case of inveterate sciatica. In 1889 J. L. Faure performed the same operation for the relief of agonizing pain in a case of cancer of the uterus. Foerster's operation, the division of the posterior spinal nerve roots for the treatment of gastric crises and spastic paralysis, based largely upon the work of Sherrington and Head, dates from 1908.

Conclusion.

What, then, has been Germany's part in all the astounding progress of modern surgery? It has been the same in surgery as in every other science. Almost all fundamental discoveries in science, Dugald Clerk tells us, have originated in England, France, and Italy. In capacity for original thought the German mind is lacking. The brilliant and happy inspiration, the penetrating insight, the new vision are things for which we seek almost in vain in all German scientific literature. The fertile new thought giving a fructifying impulse to the work of others is rarely indeed of German origin. The German mind is of quite a different order. It is avaricious, industrious, methodical; it collects, if it does not accurately appraise, the work of others. It tabulates and registers and explains; it furnishes an intricate analysis, and illustrates by copious reference any subject with which it may deal. The new idea, originating almost always elsewhere, is given eager hospitality, is dissected and discussed at inordinate length; it may be put into practice with various alterations of technical procedure, and before long be claimed as a home product. For this act of intellectual dishonesty many of the German writers were not to blame; for a study of the literature of almost any subject in medicine chosen at random will show the amazing infrequency of any reference to the English or American literature, and very few indeed to the French. Thus in Riegel's work, the article on ulcer of the stomach has four and a half pages of references, seven references are to English writers, five are to papers by Riegel himself. The name of Brinton is not even mentioned in this list, and yet it is probable that in his small book there is more of the truth of the matter of gastric diseases than in all the interminable treatises published by all the German physicians since his death. This almost exclusive reference by German writers to the works of their own countrymen was greatly helped by their publishers. In the last few years I have heard more than once from friends of my own in the medical profession in Italy, in Spain, and in Norway, that it was impossible to obtain from an English or American publisher a copy of any medical work on approval. A surgeon, desirous of seeing a new work in any special department of surgery, could only do so by purchasing the book outright and taking his chance as to the contents being to his liking. Any German publisher would send him all the books or journals he desired to see on approval. The copies of new German works on medicine were always sent to the editors of foreign journals for review. A new medical work in English was rarely, if ever, sent to Scandinavian countries, to Spain or to Italy, and to France or to Germany only in the case of a work of outstanding importance. To put this matter quite briefly, reference could always and quite easily be made by foreign physicians or surgeons to works published in Germany. It was difficult to hear of English works, and almost impossible to obtain them except by a speculative purchase. To the claims which Germany makes for intellectual supremacy we may therefore, speaking of scientific surgery, retort by a firm and flat denial. Not one single discovery of the first importance in the science or in the art of surgery can be placed to the credit of Germany. Nor, if we omit the Semitic element in the Germany of to-day, should we expect this to be the case. For the German mind is deductive; it is patient, laborious, massive; but it is not original. The German is not an innovator, but a renovator; not an explorer, but an exploiter; not a creator, but a collector.

CHAPTER II.

THE WORK OF BRITISH PATHOLOGY IN RELATION TO THE WAR.

BY

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In forming any estimate of the work carried out by British pathologists during the past two years it is necessary to bear in mind the position of medical research in this country when the war broke out. The numerous and important medical and pathological discoveries which have had their birth in England have chiefly been the work of individual men, and have owed little to co-ordinated research, though admirable work was done in the laboratories of the different universities, of the Royal College of Physicians in Edinburgh, and in many other places. Up to the year 1913 the State did hardly anything to advance knowledge in medical science; a small sum doled out yearly by the Local Government Board and some assistance given by the Colonial Office to the Schools of Tropical Medicine represented almost all that was done, though it would be unjust to ignore the valuable research work carried out by the pathological staff of the Royal Army Medical Corps. Apart from the State, such endowed institutions as the Lister Institute and the Imperial Cancer Research Fund proved that as a race we were capable of sustained and not unfruitful effort on the lines of co-ordinated research where the opportunities for this existed. Nevertheless, individualism was the rule, and each pathologist tended to devote his energies to the research which happened to appeal to him whenever he had the necessary time and freedom from financial cares. Even under these conditions the output of good research work in medical science was by no means discreditable, and Englishmen have good reason for pride in the share which this country has taken in the advance of our knowledge of disease and of its treatment.

The Insurance Act, however, promised a revolution in research. For the first time the State set aside a considerable annual sum, between fifty and sixty thousand pounds a year, for the express purpose of advancing medical knowledge, and the Act organized machinery for its intelligent expenditure. The guiding hand was exercised by a body of nine persons, the Medical Research Committee, established in 1913, and carefully chosen from amongst those known to have the power of organizing research or distinguished in its prosecution. Much time and thought were expended by this committee in elaborating their schemes of action, but scarcely had the machinery begun to move when the war broke out and interrupted most of their projects.

A gigantic war, carried out under conditions largely new, necessarily presents a continuous series of new medical, surgical, and pathological problems requiring immediate solution. It was a fortunate thing for the country that the Army Medical Service was well organized and efficient. Many of the problems which would confront us had been foreseen and their solution thought out. In particular the pathological branch of the service was well developed and excellently officered by a staff trained in the well-equipped laboratories of the Royal Army Medical College. At the onset of the war, however, the Army Medical Service found itself more than fully occupied with the necessary administrative duties which it was called upon to fulfil, so that it was impossible for its staff to deal at once with all the new questions which arose. It was now that the Medical Research Committee proved its value. It was already a "going concern," and was in a position to divert the energies which were to have been expended on research into the medical problems of a country at peace to the solution of those which arose in consequence of war. The committee therefore placed itself at the disposal of the nation, and especially at the service of the military authorities; its flexible organization enabled it to attack new problems at short notice and with maximum effect, and the value of the results which have been attained under its auspices has been in many cases immediate and remarkable, as will appear in the following pages. It will be convenient to group the chief pathological problems which have been met during the war and discuss them seriatim.

The Control of Enteric Fever.

Enteric fever, the great medical scourge of all former wars, has been reduced in this, the greatest of all wars, to insignificant proportions. Two factors have contributed to this: one was a knowledge of the "carrier" danger, which was met from the outset by the bacteriological examination of all suspected persons and their prompt segregation; the other and more important factor was prophylactic inoculation. The practice of inoculation against typhoid fever, which we owe to Sir Almroth Wright, had been tried on a small and inadequate scale in the South African war, with not wholly convincing results. It had since proved its worth in our Indian army, and the most effective methods for securing protection had been worked out in detail by the pathologists of the R.A.M.C. under Colonel Sir W. B. Leishman. The methods devised were put into practice from the beginning of the war, and in the course of a few months practically the whole army was inoculated. Small local outbreaks of enteric were promptly suppressed, and the total number of cases was extremely small in comparison with what might have been anticipated. The inoculation, however, was carried out with vaccines of *B. typhosus* alone, and the protection afforded against infection with *B. paratyphosus* (A and B) was not of high degree. During the first year of the war actually more paratyphoid than typhoid was observed amongst our troops. As the result of this experience the War Office appointed a small committee of pathologists to consider the advisability of including paratyphoid bacilli in the prophylactic inoculation. The question of dosage was carefully considered, and groups of men were experimentally inoculated with the mixed vaccine to make sure that the constitutional reaction was not too severe. The tests were satisfactory, and from the beginning of 1916 the new triple vaccine, known as T.A.B., has been the sole official vaccine for the British army, and has proved itself efficient in controlling paratyphoid as well as typhoid fever.

The pathological diagnosis of enteric fever has been complicated by the fact that practically all soldiers were inoculated men, so that the old methods of serum diagnosis became untrustworthy. At an early period of the war Professor Dreyer of Oxford drew attention to the method of carrying out agglutination reactions macroscopically with standardized killed cultures, which he had elaborated in Copenhagen some years previously. The advocacy of this method by Professor Dreyer and his colleague, Dr. Ainley Walker, led to its widespread use, and its accuracy proved such that a diagnosis could be made even in triply-inoculated men, provided that two or three observations were made at intervals of a few days, so as to follow the agglutination titres of the blood against the three bacilli respectively. The Medical Research Committee took the matter up and established at Oxford a laboratory from which standardized emulsions together with the requisite outfit for carrying out the test have been supplied free to all military pathologists, Dreyer's technique being now used almost universally. Much valuable information about the course and diagnosis of the different forms of enteric fever has resulted from the widespread use of this standard method, which has the advantage that the observations of different workers are strictly comparable.

That the freedom from enteric which has been enjoyed by our armies on the Western front is due to the care taken in ensuring inoculation, and to the sanitary precautions which have been enforced, is shown by the condition of affairs where this care was impossible and inoculation incomplete, notably in the Gallipoli expedition. Here, although there was little typhoid, the amount of paratyphoid was by no means inconsiderable, but exact figures are wanting owing to the lack of facilities for diagnosis.

Dysentery.

Of this second great medical scourge of war a less favourable tale can be told, inasmuch as no specific preventive measures have yet been devised. It has not been found practicable to employ prophylactic inoculation against bacillary dysentery, chiefly on account of the high toxicity of Shiga's bacillus, though research work on this subject is in progress, and mention may be made of the method of reducing this toxicity by the action of hypochlorites, as suggested by Professor Dean of Manchester. Prevention has therefore been reduced to hygienic precautions and to the search for carriers, and on the Western front these measures have hitherto sufficed to prevent any serious outbreak of dysentery, in spite of the return to France of large bodies of troops from the Mediterranean area. In the Eastern Mediterranean, and in Mesopotamia, dysentery has prevailed largely, both amoebic and bacillary, and has offered an opportunity for careful study, particularly in the cases returning home to this country. In the autumn of 1915 an immense number of cases of the disease returned home from the Mediterranean area, and, in order to avoid any risk of spread, were concentrated by the War Office in certain centres scattered over England. The Medical Research Committee provided laboratory assistance at these centres and were able to organize courses of instruction in protozoology for the numerous workers who were comparatively unversed in that subject. In the London district over a thousand cases were studied in full detail. and the facts which have been collected will afford a mine of valuable information on dysentery and allied diseases. Some of the work has already been published by the Medical Research Committee, namely, Dobell's report on amoebic dysentery, and that by the workers at the London Hospital on the investigation of 878 cases of bacillary enteritis from the Eastern Mediterranean. No such opportunity has ever occurred for the study of the tropical forms of dysentery in England, and many new facts have been brought to light.

The value of emetine in the treatment of amoebic dysentery has been abundantly confirmed, and Dr. Dale has introduced the double iodide of bismuth and emetine for the treatment of amoebic carriers, upon whom it has been used with successful results. Dr. Dale has also shown that the persistent administration of emetine may lead to symptoms not unlike those of the dysentery it is designed to cure.

Cerebro-spinal Fever.

Although this fever has been present amongst the British forces on the Western front, anxiety has chiefly been felt about the troops in training in England. For the first time the disease has prevailed epidemically over the whole of this country, affecting equally the civil and military populations. Strenuous efforts have been made by the War Office to control its spread, and invaluable assistance has been furnished by the Medical Research Committee in the provision and equipment of bacteriological laboratories for the purpose. Lieut.-Colonel M. H. Gordon was placed in control of the scientific work, and he organized laboratories for the diagnosis and study of cerebro-spinal fever at numerous centres throughout the country, while he himself and his immediate staff carried out research work at the Central Laboratory at Millbank. The outcome of Lieutenant-Colonel Gordon's researches promises a distinct advance in our methods of combating the spread of the disease. New, cheap, and easily prepared media for the growth of the meningococcus have been devised. A serological study of the races of this organism concerned in the epidemic has been carried out, with the result that the chief epidemic strains have been determined and a simple means for their diagnosis by agglutination placed within the reach of all pathologists. The importance of these observations is twofold. The value of a curative serum in cerebro-spinal fever depends upon whether the particular epidemic strain concerned in a given case of the disease has been employed in producing the serum. The serum available at the beginning of the epidemic, largely American in origin, was found of little value in treatment, but that prepared during 1915 from a due admixture of current epidemic strains proved of considerable curative potency. In the second place, the problem of the segregation of carriers of the meningococcus is simplified. So numerous may such carriers be at certain times that their isolation is almost impracticable Gordon therefore proposed the isolation of those carriers only who bore epidemic strains of the meningococcus. Although certain risks may be run by such limitation, it has the merit of reducing the numbers to be isolated within practicable limits, and it has been found possible to carry out this policy, at least in a military population, with satisfactory results as regards the spread of the disease. for the more dangerous carriers have been eliminated. Another useful research carried out by Lieutenant-Colonel Gordon has been in relation to the cure of chronic carriers: by causing them to breathe for a short time every day the air of a room saturated with a fine spray containing chloramine-T he found it possible to cure the majority, though not all, of such carriers within a fortnight; a special spraying apparatus has been devised for this purpose. It may be added that valuable work on the races of the meningococcus has been carried out in military laboratories in France by Arkwright and by Ellis; and, further, that a very thorough study of the same subject amongst the civil population has been going on for two years in the laboratories of the Local Government Board by Drs. Eastwood, F. Griffith, and Scott.

Other Medical Diseases Incident on Trench Warfare.

The conditions under which the troops have fought for the past two years have been associated with the appearance of epidemic diseases some of which have been known before while others have previously escaped recognition. The chief work on diseases of this character has necessarily been carried on at the front, where they are encountered in the acute stage; their clinical features have been defined by the work of the physicians and their etiology studied by pathologists at the base hospitals. Lack of space prevents our doing much more than to allude to them here, and indeed so much remains to be found out concerning most of them that few positive assertions can be made.

Trench nephritis has been exceedingly prevalent, and its course and symptomatology are now familiar, but we have failed to discover the exciting cause in spite of a large amount of work both in France and in England. The balance of evidence is in favour of the view that it is an infective malady, but no definite microbe is demonstrable, and efforts to transmit the disease to animals have so far proved unsuccessful. A very complete clinical study of this form of nephritis has been made by Captain Langdon Brown at St. Bartholomew's Hospital, so far as concerns the stages at which cases reach England, while the chemical pathology of the urine has been elaborately investigated by Captain Mackenzie Wallis. Two meetings have been held for the discussion of the disease, one at the Royal Society of Medicine and one at the Medical Society of London. At the last of these meetings Lieutenant Dunn showed a valuable series of histological preparations which he had made from recent cases in France.

Trench fever is a novel disease which received this name towards the end of 1915, when Captain Hunt and Major A. C. Rankin published an account of thirty cases. It appears to be distinct from any fever hitherto recognized, and, according to Captain McNee and Lieutenant Renshaw, who published a careful account of it in April, 1916, it assumes two forms, the second being the relapsing variety. The two latter observers were able to reproduce the disease in man by injecting the blood from active cases into volunteers for the experiment, and they further showed that the infecting property resided in the corpuscles and not in the serum. Nevertheless, they were unable to demonstrate any visible parasite in the blood, and the natural mode in which the disease is conveyed is still a matter of conjecture. Captains Davies and Weldon have, however, in one case reproduced the disease in man through the intermediation of the louse.

Infective jaundice, often known as "Weil's disease," has been of not infrequent occurrence in France, as well as in the Mediterranean area, and the infecting agent—*Spirochaeta icterohaemorrhagiae*—has been repeatedly demonstrated. *Cholera* and *typhus fever* have fortunately been conspicuous by their absence among the British forces, but admirable work was done in the control of typhus by the British hospital units in Serbia, chiefly by eliminating lice.

The Study and Treatment of Wound Infections.

This subject has naturally occupied a foremost position in the present war. The majority of modern surgeons, trained in the aseptic school, found themselves confronted by totally novel problems in the vast numbers of severe wounds, grossly contaminated by faecal bacteria, including the most dangerous anaërobes. From the first, both surgeons and pathologists set themselves to work to overcome difficulties which had never before been presented in bulk since the rise of aseptic surgery. And almost from the first two schools of treatment arose, the one condemning the use of antiseptics as a means of purging a wound of its bacteria and trusting in "physiological methods" of treatment, the other advocating germicides of one sort or another.

The apostle of physiological methods was Colonel Sir Almroth E. Wright, the chief of the Bacteriological Department of the Medical Research Committee, who was liberated for service as a consultant at the front. He occupied a pathological laboratory at Boulogne, and commenced, with the assistance of a number of fellow-workers, mostly his own trained pupils, a laborious investigation of the conditions obtaining in wounds from the point of view of pathological physiology. Whatever view may be held as to the best treatment for infected wounds, which, for the surgeon, is a matter of practical experience, it must be admitted on all hands that the study carried out by Colonel Sir Almroth Wright and his colleagues at Boulogne was a brilliant and suggestive piece of work. Various new technical methods were devised for this study, the outcome of which has been published in detail. From a surgical point of view the methods of treatment to which it gave rise consisted essentially in the encouragement of a free flow of lymph into the wound, for which purpose hypertonic salt solutions were chiefly employed. Pursued to its most extreme degree, this method developed into the packing of septic wounds with tablets of solid salt, with or without the addition of sodium citrate; such treatment was, of course, temporary, the amount of salt used being reduced after a few days. Excellent results have been recorded by those who have employed this mode of treatment in selected cases. Sir Almroth Wright has devoted much attention to the problem of the continuous irrigation of wounds with saline solutions, and has devised methods by which very successful results have been achieved.

On the other hand, a vast amount of work on antiseptics in their application to wound surgery has been carried out by pathologists and surgeons both in England and at the front. The crude attempts at sterilizing wounds by single applications of such powerful germicides as carbolic acid have been largely abandoned, though applications of a mixture of equal parts of pure carbolic and camphor have proved useful in cases where the nature of the wound permits. The most successful results, however, have been obtained through researches into the properties of the hypochlorites. Two separate sets of researches on these lines have been supported by the Medical Research Committee and have proved fruitful, and largely identical in their practical outcome. Working in Edinburgh, Professor Lorrain Smith, with the aid of three colleagues, devised a combination of bleaching powder and calcium borate which proved exceedingly efficacious in the treatment of septic wounds; they published formulae for a solution which they termed "eusol," and a powder, "eupad," which have now been extensively used, and with marked success. Quite independently, Dr. Dakin, working at Compiègne, produced a very similar solution, equally successful in its application. On the surgical side he became associated with Dr. Carrel, and the collaboration of these two workers, who have introduced a special technique for the continuous irrigation of wounds with the hypochlorous solution, has issued in a method of wound treatment which has led to marvellous results, under which, when the bacterial flora of a wound has been lowered to a certain defined point, it is safe to perform secondary closure and suture. This method of treatment, which does not conflict with that by hypertonic saline, has become increasingly popular amongst surgeons at the front, and, in the judgement of many, is the most efficient method yet introduced for dealing with septic wounds.

Dr. Dakin's researches did not end with the introduction of the hypochlorous solution, for he proceeded later, in conjunction with Professor Cohen of Leeds, to study its mode of action in the presence of proteins. It was found that the hypochlorous acid acted, not, as formerly supposed, as an oxidizing agent, but by the formation of chloramines. Amongst the chloramines whose properties were investigated were found several of considerable disinfectant power, and one of them—toluene-sodium sulphochloramide—has been introduced into medical and surgical practice on a commercial scale under the name of chloramine-T. This substance, though of fairly high germicidal value, is almost non-toxic, and has no action on albumin. It has thus been found of special value in dealing with wounds involving the mouth, and it has proved the most efficient drug, when atomized by a steam spray, in ridding chronic meningococcus carriers of their infection. It is, further, absorbed in notable amount by textiles, and chloramine gauze has been found to possess a much higher germicidal value than any other antiseptic gauze previously in use. Incidentally, Dr. Dakin found chloramine-T a useful reagent in the study of the chemistry of proteins, and he has been able to form cyanides from amino acids.

Another important application of the hypochlorites has lain in the disinfection of hospital ships. The crowding of large numbers of cases, many of them suffering or convalescent from enteric fever or dysentery, in these vessels led to a good deal of secondary infection during the voyage. The process of generating hypochlorites by the electrolysis of sea water has long been known, and Dr. Dakin devised a simple plant for this purpose, using the ordinary ship's current. This was installed experimentally on the *Aquitania*, and gave such admirable results that the method is now widely employed. One of the advantages presented by the hypochlorites as disinfectants is their extreme cheapness: the saving in carbolic acid and cresol in one voyage of the *Aquitania* was estimated to exceed the cost of the electrolytic cell and its upkeep, and the efficiency of the disinfectant produced was so great as practically to abolish cases of secondary infection.

One other disinfectant introduced during the war which deserves special mention is flavine, now termed "acriflavine." This substance, originally prepared by Benda at Ehrlich's suggestion, for the treatment of trypanosomiasis, had never been subject to proper study as a bactericide. This study was undertaken for the Medical Research Committee at the Middlesex Hospital, by Dr. Carl Browning and several of his colleagues. The research included a number of acridine compounds besides flavine, and embraced also brilliant green and aniline dyes, but the properties of flavine place it almost apart from other germicides. Nearly all the chemical substances which destroy bacteria are inimical also to living tissue cells, and impair the phagocytic functions of the leucocytes. Flavine, according to Dr. Browning's report, is largely free from these objections; that is to say, it is effective as a germicide in dilutions which are harmless to the tissues, and do not impair the phagocytic powers of leucocytes. More than this, almost all other disinfectants are subject to the grave disadvantage that their activity is hindered or even abolished in presence of albumins; it is claimed for flavine that it is a more active germicide in serum than in distilled water. The clinical trials of flavine at the Middlesex Hospital appear to support these laboratory investigations, but at the moment the stock of flavine available is not sufficient for wider trials, though its commercial production has been begun.

It need hardly be said that the opportunities for studying the bacteriology of septic wounds which have so freely offered themselves have led to a large amount of research work, the most important, because the most novel, part of which has been the study of anaërobic infections. The universality of such infections has attracted attention to them in almost every pathological laboratory, and the opportunities for investigating gas gangrene in the base hospitals in France have been well utilized, though the results have, perhaps, been of surgical rather than pathological novelty. An important observation is that of Dr. Dale, who has brought forward evidence that the so-called "toxins" of certain of the anaërobic bacilli connected with gas gangrene are really salts of ammonia.

Specific studies of the anaërobic infections of wounds have been carried out for the Medical Research Committee by several groups of observers in this country, notably by Drs. McIntosh and Fildes at the London Hospital, and by Professor Dean at Manchester; while at the Lister Institute Miss Robertson has been similarly occupied. Our knowledge of the classification and characters of these bacilli has gained much in precision and extent.

Tetanus.

In the early days of the war tetanus of a severe type was common amongst the wounded, and the control of this disease by the prompt administration of a prophylactic dose of antitoxic serum to all wounded men will rank as one of the triumphs of preventive medicine in the present war. Early in 1916 the War Office appointed a Committee for the Study of Tetanus under the chairmanship of Surgeon-General Sir David Bruce, C.B., F.R.S. This Committee has met at short intervals, and being furnished with the data as to all cases occurring in military hospitals in England, is accomplishing good work in connexion with prophylaxis and treatment, to which the appointment of tetanus inspectors in all the different military commands has been of assistance. The practice of prophylactic inoculation has not only greatly diminished the incidence of tetanus, but in large numbers of cases has profoundly modified its nature and course when it does occur. The recognition of "local tetanus" as opposed to the generalized disease was first made by French observers as a phenomenon of partial protection, and their observations have been fully confirmed by the occurrence of similar cases in this country and amongst our wounded abroad. Every gradation has been observed between a tetanus strictly limited to the wounded limb and the general disease, and it has been found that the more localized the tetanus the better is the prognosis. With regard to the treatment of declared tetanus there is still considerable dispute as to the best route for administering the specific antitoxin. The War Office Committee has from the first advocated the intrathecal route, and has instigated experimental work relating to this matter, which is not yet sufficiently advanced for publication.

The Life-History of Bilharzia.

The presence in Egypt of large numbers of Imperial Forces was attended by grave risks of the outbreak amongst them of certain of the endemic diseases of that country, and not the least of these was infection by bilharzia. The complete life-history of this parasite was unknown, and had baffled Looss and other investigators, so that there was no knowledge of the special precautions that ought to be taken. In these circumstances the Medical Research Committee co-operated with the War Office and the London School of Tropical Medicine in sending out a special mission, headed by Dr. Leiper, to study the subject. This mission successfully solved, in a few months' work, the main problem involved, proving that the intermediate host of the worm is a fresh-water mollusc; and further work during 1916 has shown that the two main species of bilharzia in Egypt have distinct intermediate hosts: that of *Bilharzia mansoni* being *Planorbis boissyi*, while *Bilharzia haematobium* has two, and perhaps three, species of *Bullinus* (*B. contortus*, *B. dybowskyi*, and probably *B. innesi*) as intermediate hosts. Cheap and efficient means have been found for rendering infected waters safe, and have been brought into use in all military camps. For the first time the way is opened up for the eradication of this grievous infection from the country, a result all the more earnestly to be desired, since no means of destroying the worm has been found when once it has established itself in the human body.

Trench Foot.

Very large numbers of men were invalided from the Western front during the winter of 1914–15 with the condition at first regarded as frost-bite, but now commonly termed "trench foot." Professor Delépine investigated this subject at Manchester, while Professors Lorrain Smith and Ritchie with Dr. Dawson carried on a research for the Medical Research Committee at Edinburgh. It has been shown that "trench foot" is a minor state of frost-bite, the damage inflicted being usually short of immediate death of the tissues. The experimental work of Lorrain Smith and his colleagues upon the rabbit shows that the primary lesion is vascular, with a secondary inflammatory reaction when the subject is removed from the causal environment. The difference between this and true frost-bite is one of degree only, and the severer forms of trench foot end in gangrene. Professor Delépine has shown the importance of a layer of air surrounding the lower extremity in preventing trench foot, and has devised a simple and light bag of oiled silk which can be worn by those exposed to continuous wet and cold in the trenches, and which has proved a considerable safeguard.

The foregoing short account of what has been accomplished during the war by British pathologists is necessarily incomplete. Much that has been done may not yet be written about, and no attempt has been made to enter into full details as to that which is already public property. This slight sketch of some of the more important work which has been accomplished will suffice to show that in pathology, no less than in the other sciences, advances have been made under the stress of national necessity, during the two years and a half of war which could hardly have been expected in twenty years of ordinary work; and although it has been "war work," it represents a solid contribution to science which will be valid for the years of peace to come.

CHAPTER III.

BACTERIOLOGY AT THE FRONT.

BY

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Bacteriological investigation in hospitals of the front line has been a novel feature of this war. Nothing of the kind has been practised in any of our previous campaigns. It has been rendered possible by equipping motor vans as mobile laboratories. The first, which was sent out in October, 1914, had been a pleasure caravan. It was gutted and fitted with incubators and all the other apparatus of bacteriological work, and was followed by many others of the same type. They have been attached to a clearing station or a group of clearing stations, and the officer in charge is provided with a small motor car, so that he can go to any place in his area where his services may be wanted.

These officers perform three functions:

1. They examine all kinds of morbid products from the hospital wards, and thus aid in the diagnosis of enteric fevers and other epidemic diseases on the medical side, and of the various forms of infection that attack surgical wounds.
2. They examine contacts in cases of infectious fever and search for carriers both among the troops and in the civil population.
3. They investigate new forms of disease that appear among the troops in order to discover their causes and the means of prevention.

Instances of the first class of work are the examinations made of the blood and excreta in cases suspected of enteric fever, of malaria, or of dysentery, and of the cerebro-spinal fluid, or the nasal mucus where cerebro-spinal fever is in question.

In the first year of the war the diagnosis of enteric at the front was comparatively easy. But when, in January, 1916, the triple inoculation against typhoid and paratyphoid A and B came into use, it became much more difficult. Firstly, the culture of the bacilli from the blood is very uncertain in inoculated men after the first three days of fever, and, since the early symptoms are slight and are not distinguishable from those of many other fevers that prevail, few patients arrive at a clearing station within that time. Secondly, the triple inoculation so complicates the agglutination test that it is only after three or four trials and a comparison of the results that a conclusion can be reached. As this takes twelve or fourteen days it is only carried out at the front in the comparatively few cases that are retained in the infections hospitals there, nor is it, even with the repeated examination of the excreta in addition, always possible to obtain bacteriological evidence in cases where the clinical symptoms render the diagnosis certain.

In the case of cerebro-spinal fever, Captain Ellis, of the Canadian Mobile Field Laboratory, established at the same time as Lieutenant Colonel Mervyn Gordon at home the existence of different types of the meningococcus distinguishable by agglutination and absorption tests.

During 1915 cases were also observed in which, with acute symptoms just like those of cerebro-spinal fever, the cerebro-spinal fluid, though under high pressure, contained no polymorphs and no meningococci, but lymphocytes in excess. This condition we called lymphocytic meningitis. It was never fatal. Later on several cases of meningococcal septicaemia, which is a very acute and rapidly fatal disease, were discovered by the bacteriologists.

Certain cases of dysentery occurred and were accompanied by a considerable amount of non-dysenteric diarrhoea. A large amount of diagnostic work was carried out by the mobile laboratories of this area.

The next function of these officers is to discover the source of an infection, and to stop it from spreading. In cases of enteric the work was very elaborate. In the first place, a systematic search was made for recent or chronic carriers among the troops. Thus, in one regiment a carrier was discovered in the regimental kitchen. In another, which had lately received reinforcements, no less than 96 men had to be examined before the carrier was found. But the source of infection was not always in the troops. The part of Flanders that we held was a hotbed of enteric, and many cases were found in the civil population. The search for these, in which the bacteriologists were aided by the Belgian sanitary officer, Dr. de Wulf, and also by the Society of Friends, was very difficult. In one village cases of enteric occurred in three successive formations that were billeted there. No civil cases could be traced, until news was brought of a child that had been sent away to convalesce at a neighbouring farm. The clue was followed, and the family to which the child belonged were identified as the source of the outbreak. They kept an estaminet, and sold food to the soldiers. Many carriers of dysentery have also been discovered and isolated.

The conditions of warfare made it far less possible to obtain contacts of cerebro spinal fever at the front where men are constantly moving, than it is at home where a man may be stationary for weeks.

The subject is extremely difficult, and even now the method of diagnosis that satisfies one bacteriologist is held insufficient by another. I do not remember any instance in which we could connect two cases of the fever as cause and effect, or as caused by the same infection. They have been very uncommon, even under the conditions at home.

As instances of the examination of new or little known forms of disease, I may mention trench fever,[1] investigated by Captain McNee; spirochaetal fever,[2] by Captain Adrian Stokes; gas gangrene;[3] and the histology of the prevalent nephritis, by Lieutenant Dunn.[4]

As these researches will no doubt be dealt with under their separate headings, it needs only to refer to them here as examples of excellent work done in the laboratories of the front and of the importance of this organization.

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TRENCH FEVER AND ITS ALLIES.

IN the first winter of the war there were many cases of stiffness and pain in various parts, especially in the muscles of the back and shoulders, with some fever, and there were also a few cases which were thought to be influenza, but in the spring of 1915 our attention was drawn to the frequency of a form of fever which struck every one as novel. The men were often seized suddenly, perhaps when performing a duty, with a vertigo or faintness so severe as to drop them in their tracks. A severe headache, especially at the back of the eyes, and a pain in the back began almost at once. Occasionally there was pain in the left hypochondrium. When the men reached the clearing station they complained of much pain in the legs, especially down the shins. Many could not bear the pressure of the bedclothes. In some the pain was rather in the muscles of the thigh, and in a few it was felt in the calf. Along with these symptoms the tongue was furred, the appetite bad, nausea was not infrequent, and the bowels were constipated. There was no cough, and the lungs were unaffected. The pulse was from 70 to 80, and the heart was natural. The spleen was not enlarged, and there was no albuminuria. The temperature rose quickly, reaching 102° F. or more on the second day. Occasionally the temperature rose to 105° F., and was accompanied by stupor. It fell on the third and fourth to normal, and then in many cases rose again on the fifth or sixth day, to fall again on the ninth or tenth. This saddle-backed curve resembled that of the phlebotomus fever of the Mediterranean, and the symptoms were not dissimilar, though milder, but there was no phlebotomus in this country.[1] [2]

As further cases were observed, it was discovered that the relapse might take place at different intervals, even after ten days of a normal temperature, but that for each patient the cycle was regular. Thus in one patient the cycle might be seven days, in another ten, and in another even thirteen days. The periods of normal temperature lasted five, eight, and eleven days respectively, and were interrupted by a sudden fever, which might rise to 104° F. and as quickly disappear. As the disease continued the fever rose each time to a gradually lower level, and the intervals might become longer.[3]

In a large number of cases there was only one bout of fever. Many had only one relapse, but if there was more than one there were frequently many, and such a patient might continue ill for many weeks.

Such charts as these, with a sharp and sudden rise, separated by regular and afebrile periods, were strongly suggestive of the life-cycle of some blood parasite, and every method was followed which gave hope of its discovery. Up to the present no such body has been found, but it has been shown that the fever can be communicated by the blood from a patient if injected into a healthy man, and, further, that the virus is connected with the red blood cells and not with the serum. It has been a common opinion that whatever the virus may be it is conveyed by the louse, and there are a few facts to support this.[4]

No case proved fatal, and the great majority made a speedy recovery, but some were left with irregularity of the heart, which persisted for a long time. Cases of recurrence after intervals of good health were not unknown; it was evident that one attack did not produce immunity.

Many drugs—including the salicylic acid compounds, and quinine by the mouth, and salvarsan, and antimony by injections—were tried. None had any effect upon the course of the fever. In a few cases aspirin, and in more morphine, relieved the pain temporarily.

Along with this relapsing form, which was called trench fever, there were others which showed no relapse, though the symptoms were the same. Some of them had a hog-backed curve, the highest points lying towards the middle of the curve, which fell to normal about the tenth day. Others had a low pyrexia, never rising much above 100° F., but lasting a fortnight or three weeks. In the summer of 1916 a number of cases of short fever were seen in which the spleen was enlarged. These cases were occasionally observed at other times. They were probably a special form.

Some thought that they could distinguish a special type which they called shin fever, but this could not, on wider investigation, be established. It should be added that pain in the shins was not peculiar to any fever. It was seen in typical cases of enteric.

Some bacteriologists found various infections in the blood of these cases, but their results were not confirmed.

The chief diseases from which these fevers had to be distinguished were one of the enteric fevers and influenza. It was not until repeated examinations, extending over some hundreds of cases, had been made that we felt justified in excluding the former. Influenza is so protean a disorder that its exclusion was still more difficult. There were in these fevers, however, no catarrhal symptoms, the *B. influenzae* was never found in the blood, and the cases occurred only at the front or among the personnel of hospitals where the cases were treated. It was not a general epidemic as influenza usually is.

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CHAPTER IV.

BIOCHEMISTRY AND WAR PROBLEMS.

BY

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THE application of science to every department of modern warfare is universally appreciated. Without the co-operation of the engineer, the physicist, and the chemist, warfare could not approach its present destructive character. But, apart from these activities, the importance of which can hardly be over-estimated, a large amount of purely scientific endeavour has been devoted to the conservation of the health of those taking an active part in the present struggle. The object of the following notes is to indicate a few striking examples of what may be termed constructive applications of biochemistry.

PURIFICATION OF WATER.

The supplying of a large army in the field with safe and palatable drinking water is obviously a problem of immense practical importance. The difficulties encountered, particularly when troops are living in typhoid-infected areas, were great, but the sanitary service of the army has every reason to feel proud of the great success it has achieved in this direction. The use of chlorine compounds for the sterilization of polluted waters has long been practised, particularly in typhoid-infected areas in America, but the application of the method on a huge scale to field conditions required additional experience and experiment. The care bestowed in the control of the army water supplies by both chemical and bacteriological methods has been fully justified by the results, and if the publication of statistics were permitted, it would appear that some other nations had still much to learn in this direction. While the excellent typhoid statistics of the British army are doubtless in large measure due to protective inoculation, the efficient supplementing of this procedure by the provision of safe water supplies is no inconsiderable factor.

ACCESSORY FOOD FACTORS (VITAMINES).

Questions of diet are of no less importance than water supply. In recent years biochemical studies have indicated the necessity of the presence of certain substances in relatively small amounts in order to make an otherwise ample diet adequate for maintenance or growth. The earliest experiments of this kind were made at Cambridge by Professor Hopkins and Miss Wilcox. They found that mice furnished with a diet containing liberal amounts of fat, carbohydrate, and protein, which were much more than sufficient to furnish the energy requirements of the organism, failed to sustain life if a particular amino-acid, discovered by Hopkins, was not a constituent of the protein. This heterocyclic amino-acid, tryptophane, systematically named indole α–aminopropionic acid, was found as a constituent of many proteins, but not all. It is absent, for example, from gelatine, this being one reason why gelatine is an incomplete protein food. Hopkins and Wilcox found that addition of small amounts of tryptophane to the inadequate diet just referred to was followed by marked improvement in the condition and duration of life of experimental animals. A most valuable discussion on the importance of individual amino-acid groupings in proteins for nutrition and growth has recently been published by Hopkins in his lecture at the Chemical Society, May 18th, 1916.[1]

Later experiments showed that young animals could not grow when fed upon so-called "synthetic" diets consisting of mixtures of pure proteins, fats, carbohydrates, and salts, although maintenance might be secured for a considerable time. But Hopkins[2] found that a substance or substances found in normal foodstuffs (for example, milk) can, when added to the dietary in astonishingly small amounts, secure the utilization for growth of the protein and energy contained in such artificial mixtures. The significance of these observations with regard to diseases such as scurvy, rickets, and beri-beri was at once apparent.

Late work by Hopkins, and a host of followers, has served to emphasize the importance for nutrition and growth of these small amounts of substances which are often called "accessory factors" or "vitamines." Some of the subtances which are found in milk, yeast, whole rice meal, and animal tissues, are extraordinarily potent in the relief of polyneuritis induced experimentally in birds by feeding on a "vitamine"-free diet of polished rice. The exact nature of these substances is still obscure, although Funk,[3] working at the Lister Institute, Suzuki in Japan,[4] Moore and co-workers,[5] Cooper,[6] and others, in England, have obtained partly purified basic products of high potency. The practical importance of these studies has been amply justified by the success obtained in the prevention of scurvy, beri-beri, and similar nutritional disorders among troops operating under conditions which render the abundant supply of fresh food difficult or impossible. By supplementing the diet available under such circumstances with small amounts of material rich in "vitamines," it has been possible to restrict the development of the disorders mentioned in a way that would have been impossible even a few years ago. A large number of experiments as to the most practical form of supplying the needed vitamines has been carried out under the direction of the authorities concerned, who were keenly alive to practical lessons to be learnt from the laboratory studies just referred to.

It is of interest to note that some recent experiments of Williams[7] upon the curative action of various substances on experimentally induced polyneuritis in birds appear to show that certain synthetic pyridine derivatives containing a betaine-like ring possess this property in high degree. A substance intimately related to the purin compound adenine has been isolated from yeast, and also found to exert curative action. The necessity for purin derivatives for the synthesis of nuclear substance *in vivo* is noteworthy in this connexion. It may reasonably be expected that the more intimate analysis of metabolic processes which is being made possible by the pioneer work of Hopkins will find many applications in the treatment and prevention of nutritional disorders.

Wound Infections.

Few subjects have attracted more urgent attention during the present war than the question of the treatment of infected wounds. As every one knows, this problem has surpassed in difficulty anything which had previously been experienced, both as regards the frequency and malignity of wound infections. Apart from special surgical procedure and protective inoculation, with which we are not concerned at the moment, the problem has been chiefly attacked in two ways.

Hypertonic Salt Solutions.

The method advocated by Sir Almroth Wright demands the employment of salt solutions of varying concentration but of slight germicidal action. Hypertonic salt solutions are used to provoke an increased flow of lymph from the wound surfaces with the object of facilitating and accelerating the natural processes of repair. The other methods which are in vogue involve the use of more active chemical agents—antiseptics—with the aim of reducing infection by more or less direct germicidal action. There has been a great deal of discussion as to the rival merits of the two systems, but to some observers at least it would appear that the differences between the so-called "physiological" and "antiseptic" methods of treating wounds are not nearly so great as at one time appeared, and that the effects sought by the best exponents of the two methods have much in common.

Antiseptics.

At first, prime importance was attached to the search for the most actively germicidal substances as judged by their action on micro-organisms suspended in various media outside the body. With the aid of these substances much was expected in the way of rapid wound sterilization, but the results were mostly disappointing. The problem was evidently not to be solved in this way, and the idea that dirty lacerated wounds could be sterilized by isolated applications of powerful antiseptics had early to be abandoned. The exponents of physiological methods did genuine service in indicating the danger and futility of such a procedure, and it was soon realized that where, as was the rule, sterilization was not effected, the concomitant injury to living tissue by the unintelligent application of corrosive antiseptics might far outweigh any advantage gained. But at the same time it cannot be too strongly insisted that experiences of this kind cannot be taken as refuting the value of every kind of antiseptic treatment. With the desire to secure crucial experiments to prove the inutility of antiseptics, wounds have been extensively swabbed with pure carbolic acid with the avowed intention of giving the antiseptic every chance. Yet, in the light of the experience of the last thirty months, the finding of organisms in the discharge from any but trifling wounds treated in this way was almost a foregone conclusion, and proves nothing as to the efficacy of antiseptics in general when employed under proper conditions.

When it was realized that the immediate sterilization of badly infected deep wounds by a single application of a "strong" antiseptic, even when applied soon after the infliction of the wound, was rarely successful, attention was turned to the repeated or even continuous application of relatively mild antiseptic solutions, and here genuine success appears to have been obtained.

Hypochlorites.

Of the innumerable antiseptics which have been employed in the present war two appear to have been regarded with especial favour, and they have much in common. These are the calcium hypochlorite and boric acid mixture introduced by Professor Lorrain Smith under the name of "eusol,"[8] and neutral sodium hypochlorite solution, the preparation of which was described in this JOURNAL.[9] The composition of the latter solution has been modified by various writers in minor details without much essential change. Although the germicidal action of hypochlorites has long been made use of for water purification and other similar hygienic purposes, until recently they had seldom been used for surgical purposes, except occasionally for the removal of sloughs. One reason for this is undoubtedly to be found in the fact that commercial hypochlorite preparations commonly contain free alkali, and hence are intensely irritating. The presence of free alkali is guarded against in the preparation of the two solutions just mentioned by substantially the same method, which may be incidentally referred to as illustrating the application of a well-known physico-chemical principle. It has long been known that when a polybasic acid, such as phosphoric or carbonic acid, is partly neutralized by successive additions of alkali, a point is reached when the solution contains a mixture of acid and neutral salts which reacts approximately neutral to suitable indicators. To such a solution moderate additions of either acid or alkali may be made without changing the reaction of the solution, the only change being variations in the proportions of various salts. This mechanism, as Henderson and others have shown, is largely responsible for the maintenance of the essential neutrality of blood and other body fluids under changing conditions. In the case of the antiseptic solutions under consideration, the polybasic boric acid was chosen for adding to the alkaline hypochlorites, so that the resulting solutions were capable of maintaining neutrality. Using similar principles, Daufresne has developed a hypochlorite solution containing no boric acid but a mixture of carbonate and bicarbonate. Such solutions are referred to as "buffer solutions," indicating their ability to reduce the actual change of reaction due to the addition of either acid or alkali.

These hypochlorite preparations are probably used more widely than any other antiseptic solutions at the present time, not only in our own Army Medical Service but in the allied countries, and from recent reports it appears that the Germans have been making extensive use of them as well. They were both developed as the result of work carried out on behalf of the Medical Research Committee. The wide adoption of these antiseptics in preference to those more generally used prior to the war is significant, especially in view of the disfavour with which antiseptics in general were regarded a short time after the outbreak of the war, as a result of their comparative failure to meet the demands then made upon them.

This preference for the hypochlorite antiseptics as compared with many others appears to be supported by both clinical results and by laboratory investigations. The solvent action of hypochlorites on necrotic tissue is a great advantage when contrasted with the coagulating effect of many antiseptics on blood serum and wound exudates. The former action of hypochlorites permits the wound surface to remain moist and so removes obstacles to the outward flow of lymph, which is so readily checked by antiseptics which are protein precipitants. Moreover, the hypochlorites, by virtue of their strong oxidizing power, appear to react readily with the toxic products of bacterial activity—and indeed this action, as will be referred to later, has been used by Dean for the preparation of dysentery toxin of greatly diminished toxicity, but otherwise potent for the production of antibodies. The diminution in general toxaemia following the free use of hypochlorite in old, badly infected wounds, especially fractures, in which sterilization is incapable of attainment, is a common observation, as well as the increase in the toxaemia following its abandonment or replacement by some other solutions. Furthermore, from the experiments of Wright,[10] it appears that hypochlorites are preferable to antiseptics such as phenol or iodine, since they differ markedly from the latter in being less disturbing to a favourable balance between the antitryptic and tryptic effects in fluids such as are formed by wound secretion. Wright regards this as the probable explanation of why wounds treated with hypochlorite suppurate less and heal better than did the wounds treated in the earlier period of the war with the antiseptics then in use. The suggestion that antitrypsin plays an important part in the normal bactericidal properties of blood, as put forward by Wright and others, has an obvious connexion with the above opinion, and in this relation it may be recalled that hypochlorites, like many other active chemical substances, when injected intravenously into animals, produce first a fall and then a marked rise above normal of the antitryptic value of the blood serum.

Synthetic Dyes as Antiseptics.

The selective antibacterial action of certain synthetic dyes (crystal violet, malachite green, etc.) has long been applied by bacteriologists in the preparation of differential culture media. The work of Ehrlich and his school on the specific therapeutic action of certain dyes in protozoal infections is also well known. The special need created by the war for substances of low toxicity to the tissues of higher animals, but of high antiseptic potency, has led to the use of several dyes for the disinfection of wounds. Very good results have been obtained by using dyes of the triphenylmethane series (crystal violet, malachite green, brilliant green). Fildes, Rajchman, and Cheatle,[23] who were among the earliest workers to apply the disinfecting action of such dyes to wound treatment, used a mercury compound of malachite green, sprayed on to the wound surface in alcoholic solution, and obtained better results than with either malachite green or mercuric chloride alone. A recent publication by Browning[24] deals with a further development of the use of dyes as antiseptics, and describes results of extraordinary interest and promise, obtained with a dye of the acridine series, of which the trypanocidal value was studied some years ago by Ehrlich. This substance, "trypaflavin" (diamino-methyl acridinium chloride), has been found to have a high general antiseptic value by Browning, who, on account of this more general application, proposed to call it "flavine." Browning finds that, while the antiseptic action of all other substances examined, including the dyes mentioned above, is greatly diminished by the presence of blood serum, that of flavine is not only not diminished, but is conspicuously increased, even to five times its potency in water. This, taken in conjunction with Browning's further observation that flavine is harmless to the tissues, and even to the activity of leucocytes, in concentrations having a strong antiseptic action, awakens great expectations concerning its therapeutic value in various infections. Preliminary trials have already confirmed its efficacy in the treatment of septic wounds, and the results of the more extended trial, which will be carried out under the Medical Research Committee as soon as adequate quantities of the dye are available, will be awaited with interest.

THE CHEMISTRY OF DISINFECTION.

But the measure of success achieved by many surgeons in the treatment of infected wounds with hypochlorite antiseptics has been due to much more than the substitution of one antiseptic lotion for another. Granted that hypochlorites possess certain advantageous properties not shared by other antiseptics, their employment requires the observance of other essential conditions if success is to be obtained. The development of these conditions, apart from the necessary surgical interference, was based on laboratory work. The researches of C. J. Martin and Miss Chick have done much to supply accurate information as to the laws of disinfection. From studies on the rate of disinfection by mercuric chloride, silver nitrate, and phenol acting on *B. paratyphosus* and spores of *B. anthracis*, Miss Chick[11] concluded that a very complete analogy existed between ordinary chemical reactions and the process of disinfection, one reagent being represented by the disinfectant and the second by the protoplasm of the bacterium. In the case of the spores the process of disinfection proceeds with a reaction velocity in accordance with the well-known equation for a unimolecular reaction, if figures representing "numbers of surviving bacteria" are considered and taken as the equivalent of "reacting substance." In the case of *B. typhosus* departures from the simple law were noted owing to permanent differences in resistance to the antiseptic among the individual organisms. The rate of disinfection in all cases was greatly increased by rise in temperature, the velocity being increased three to ten fold by an increase of ten degrees Centigrade.

If the act of disinfection be thus regarded as a chemical reaction proceeding with a definite velocity, the successful use of antiseptics will depend on the establishment of conditions such that the reaction may be pushed as far as possible towards completion in any given period of time. Increase in the active mass of antiseptic and rise in temperature will favour the course of the reaction, but in the case of wound treatment these factors are obviously limited by other considerations. In the case of hypochlorites, the maintenance of an effective mass of antiseptic in a wound cavity is a difficult problem on account of the ease with which these substances enter into combination with proteins and other compounds in the wound exudate. Of these products, those which contain active chlorine united to nitrogen retain their germicidal action while the others lose it entirely. It is for this reason that the technique employed by those who obtain really satisfactory results with the hypochlorite antiseptics requires such careful observance. The repeated renewal of hypochlorite solution in wounds which have received adequate preliminary surgical treatment is a practical necessity that is easily understood if the rate of its disappearance is borne in mind, but this has too often been overlooked by those who hope to find special curative action following infrequent administration of these antiseptics. The technique employed by Carrel and Dehelly in France and by Sir Berkeley Moynihan[12] and many others in England, by which frequently renewed quantities of hypochlorite—the amount varying with the character and surface extent of the wound—are injected into the cavity and its recesses by means of rubber supply tubes, is a natural consequence of the chemical properties of the antiseptic they employ. As in the case of the treatment of wounds with hypertonic salt solution and other irrigation methods the technique is of prime importance, and success or failure depends to a greater extent upon this than upon minor details in the composition of the solution.

The widespread adoption of hypochlorites for antiseptic purposes invited chemical studies as to their mode of action. Apparently there are great differences in the way antiseptic substances act. Miss Chick's experiments confirmed the view that the metallic ions resulting from the electrolytic dissociation in solution of salts such as mercuric chloride and silver nitrate are the real disinfecting agent rather than the salts as a whole, and this conclusion is in harmony with some unpublished results showing that some double cyanides of silver which do not dissociate normally have a surprisingly low germicidal action. Cooper,[13] working at the Lister Institute, concluded that the germicidal action of phenol is not due to a typical union of the phenol with bacterial protoplasms, as is probably the case with formaldehyde, but rather to a de-emulsifying effect upon a colloidal suspension of some constituent protein essential for the vitality of the organisms. In the case of hypochlorites direct chemical action upon bacterial proteins, and any other protein which may be in the medium, undoubtedly occurs, and the germicidal substances so formed may contain much active chlorine linked to nitrogen as NCl groups. A systematic study of many synthetic substances containing this grouping led to the conclusion that almost all of them possessed high antiseptic properties, and one of them, toluene sodium sulphochloramide, or chloramine-T, has been used on an extensive scale. Its manufacture was first undertaken in England, and it is now made by many firms here and abroad. Apart from the use of the substance for general antiseptic purposes, its stability permits its use in very dilute solution under conditions in which hypochlorites would be too irritating. One of the most interesting applications of this substance has been worked out by Colonel Gordon and published in this JOURNAL. Carriers of the meningococcus, when placed in an inhalatorium and subjected to the action of a steam spray carrying the antiseptic in fine suspension, have been freed from this organism in satisfactory manner, and the successful extension of the method to other infections of the upper respiratory passages seems likely. Here again, as in the use of antiseptics for wound treatment, details of technique in the presentation of the drug are of cardinal importance.

SYNTHETIC DRUGS.

Among the many tasks which confronted chemists at the outbreak of the war, few were more urgent than that of preparing adequate quantities of certain drugs for the supply of which we had previously been dependent on hostile countries. Much of this work has been done in a successful and unobtrusive way in the laboratories of chemical manufacturers, while in other cases the assistance of organic chemists on the staff of our universities has been freely and cheerfully given. It is unnecessary to go into details with regard to the individual products, which cover a wide range, but, as is well known, the demand for arsenical compounds of the type of salvarsan and various local anaesthetics such as novocain and eucaine was particularly heavy and has been well met. It will be recalled that the latter substance is an acetone derivative, and in this connexion reference may be made to the development in this country, since the war commenced, of the industrial production of acetone by a fermentation process. This new industry promises to be of great utility. Salvarsan and its congeners and the local anaesthetics are now produced in a thoroughly successful fashion not only in this country but also in Canada. The control of the quality of salvarsan offered for sale in this country has been cared for by the Medical Research Committee, while in Canada the manufacturers' product is tested in the laboratories of the Pathological Department of Toronto University.

An interesting investigation on the fate of salvarsan and neo-salvarsan has recently been published by W. J. Young.[14] This author finds that these substances, when injected intravenously into goats, give rise to the presence of arsenic in the blood plasma and corpuscles in a form which cannot be removed by dialysis but which can be precipitated with the serum proteins by tannic acid. A similar behaviour is shown by atoxyl. No such combination could be observed when inorganic arsenic preparations were injected, and it would appear as if the varying therapeutic effects of different types of arsenic preparations depended, at least in part, on whether non-dialysable arsenic appears in the blood. Careful studies of the rate of arsenic excretion following administration of salvarsan and neo-salvarsan have been published by Webster.[15]

Although so much remained to be done to supply existing demands, a few new therapeutic products of approved value have been introduced. Among these mention must be made of the introduction of emetine bismuthous iodide by H. H. Dale [16] for the treatment of carriers of amoebic dysentery. This substance was suggested by Du Mez as of possible value, and Dale's work has definitely shown that carriers who have long been treated without success with emetine administered hypodermically in the ordinary way, can be freed from infection by the new drug, which, unlike emetine itself, can be given by the mouth.

A new synthesis of β-iminazolethylamine, a substance which was shown by Barger and Dale to be one of the most physiologically active constituents of ergot, has come to light in a rather curious way. In studying the oxidizing action of the antiseptic chloramine-T upon various amino acids derived from proteins, it was found that many of these substances were converted into cyanides with one less carbon atom than the original substance. Histidine, for example, gave cyanomethylglyoxaline, and the latter substance, as was already known, gives the active β-iminazolethylamine on reduction.[17] The reaction promises to be of technical value for the preparation of this and allied physiologically active amines.

Pharmacological Research.

In relation to pharmacological research, reference must be made to an extraordinary investigation in the chemistry of the opium alkaloids recently published by W. H. Perkin.[18] The work mainly deals with cryptopine, an alkaloid occurring in such small quantities that 10,000 lb. of opium were needed for the preparation of 5 oz. of the hydrochloride. The breaking down of cryptopine, mainly by oxidation under carefully regulated conditions, with the formation of substances either of known structure or which were subsequently synthesized, and the deduction of the probable molecular arrangement of the parent alkaloid from the structure of these simpler derivatives, is a triumph of experimental skill and theoretical insight. Scores of new compounds were carefully characterized in the course of the work, which throws much interesting light not only on the structure of cryptopine and protopine, but on other related alkaloids. It is of course unnecessary to refer to the fact that it is to researches such as these that we owe inspiration and direction, not only in the work of the synthetic preparation of the natural alkaloids of therapeutic value, but in the artificial synthesis of new drugs.

Cushny [19] has lately made some noteworthy observations on the pharmacological antagonism existing between atropine and pilocarpine. These experiments were made on the salivary secretion, and showed that in different dogs a constant amount of atropine was necessary to oppose the action of a constant amount of pilocarpine, and in the same dog the ratio of the two drugs remained the same, irrespective of how the actual amounts injected might vary. It appears, therefore, that the antagonism proceeds according to the laws of mass action rather than those of simple chemical combination in definite proportions. The investigation is an interesting example of the application of physio chemical methods to the elucidation of the mechanism of the action of drugs.

Antitoxic Serums.

Reference has already been made to the discovery by H. R. Dean and R. S. Adamson [20] that the toxicity of Shiga dysentery vaccines could be enormously reduced by the restricted action of hypochlorites and other oxidizing agents without lowering their immunizing power. This gratifying and rather surprising result has been abundantly confirmed, and points the way to a number of other allied problems of practical importance which might be successfully attacked, especially if an adequate analysis of the chemical reactions concerned should result from further investigation.

One result of the war has naturally been an enormously increased consumption of various antitoxic serums. The concentration of serums by the use of fractional precipitation of the contained proteins by salts such as ammonium sulphate has led to the preparation of high titre serums from which much of the inert material has been removed. In a recent communication from the antitoxin laboratories of the Lister Institute at Elstree, Miss Homer [21] has described a number of practical improvements in the methods originally developed by Banzhaf and Gibson, which promises to make the method easier to carry out and to give more uniform results.

Theoretical studies by Dale and Hartley [22] on the relation of anaphylaxis to different serum proteins offer some practical considerations. They show that each and all of the individual proteins of a serum can act as anaphylactic antigens, and that the ideal to be aimed at in concentrating the curative elements in a specific immune serum is simply the reduction of the ratio of total protein to antitoxic value. For the purpose of reducing serum reactions the elimination of albumin appears to be as important as that of the euglobulin when, as is usually the case, the pseudoglobulin is the fraction carrying the therapeutic power. Dale and Hartley find that the latent period of sensitiveness to albumin is relatively long compared with the globulins, and this may have a bearing on the successive crops of serum rash which have been recorded as following a single injection of serum.

Protection against Poisonous Gases.

In closing, reference must be made to an extremely important branch of biochemical work about which, for obvious reasons, little can be said. The introduction of gas warfare by an unscrupulous and inhuman foe at once led some of the ablest chemical and physiological investigators in the country to devote their energies to devising the best methods of protection against asphyxiating gas and lachrymatory shells. The ingenuity displayed by the enemy in employing every conceivable means of chemical attack has been steadily met by corresponding improvements in methods of protection. These researches, often conducted at considerable personal risk, have presented problems calling for rapid solution, which demanded the highest grade of scientific work, and it is unfortunate that more cannot at present be written of the admirable way in which these problems have been solved. No line of scientific endeavour is more appealing than that of giving to our own and allied soldiers the best possible protection against this barbaric form of attack, and the success that has been attained must be universally appreciated.

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CHAPTER V.

MEDICINE AND THE SEA AFFAIR.

INTRODUCTION.

BY

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This outline of the work of the medical service of the Royal Navy, necessarily brief from the exigencies of space, may well be prefaced with the satisfactory statement that the health of the service afloat has been excellent—better, indeed, than in times of peace. This fortunate result is due to several factors: in the first place, to the efforts of preventive medicine and hygiene, especially the improved ventilation of warships introduced shortly before the outbreak of war, a subject more fully dealt with on pp. 537–539; in the second place, to the healthy isolation of the Grand Fleet, far from the temptations of seaports; thirdly, to the minute precautions taken in drafting men from the shore dépôts to the fleet, which entail due quarantine after exposure to infectious fevers; fourthly, to lectures by the medical officers to the ships' crews dealing with personal hygiene and insisting on the results of alcoholic excess and the dangers of venereal disease; and, further, to the care taken by all officers, by keeping the men physically fit by means of exercise, and by combating in various ways the effects of monotony and relative inactivity, to maintain the high spirit of confidence in eventual success.

At the outbreak of war the medical personnel was at once expanded by the mobilization of the retired, emergency, and Volunteer Reserve medical officers, by the creation of a large number of temporary surgeons for the period of hostilities, and by the appointment of about ten consultants (two being anaesthetists), including Sir Watson Cheyne, President of the Royal College of Surgeons of England, and Sir William Macewen, Regius Professor of Surgery in Glasgow. Rather later an old type of naval medical officer, the surgeon's mate, was revived in the enrolment as surgeon-probationers R.N.V.R. of medical students who had passed the examination in anatomy and physiology, and who had begun, but not completed, their clinical work. They were placed in torpedo-boat destroyers and other small vessels which otherwise do not carry medical officers, so as to render first aid, and, as the records of the Jutland battle show, this trust was fully justified. The sections which follow have been contributed by medical officers responsible for the subjects dealt with.

MEDICINE AND CLINICAL PATHOLOGY.

BY

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AND

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The general methods of diagnosis and treatment are naturally the same in naval and civil hospitals, and do not, therefore, require any description. The association between clinical and laboratory work is as close as in the metropolitan hospitals with teaching schools attached, and new methods of diagnosis are thus tested and utilized to the full.

The increasing tendency of modern medicine towards subdivision and specialization has been reflected on the navy by the assignment of temporary surgeons with previous experience of special branches of their profession, such as ophthalmology, neurology, tuberculosis, otology and laryngology, and bacteriology, to the care of such patients and duties. Up-to-date departments for *x*-ray work, dentistry, massage, and electrical treatment are attached to hospitals where the sick-berth staff are trained for the service afloat. The work of the laboratories of the large base hospitals was assisted by the utilization of men with scientific knowledge but without medical qualifications. The Medical Research Committee sent Dr. P. Fildes to Haslar as a bacteriological expert, and afforded other facilities.

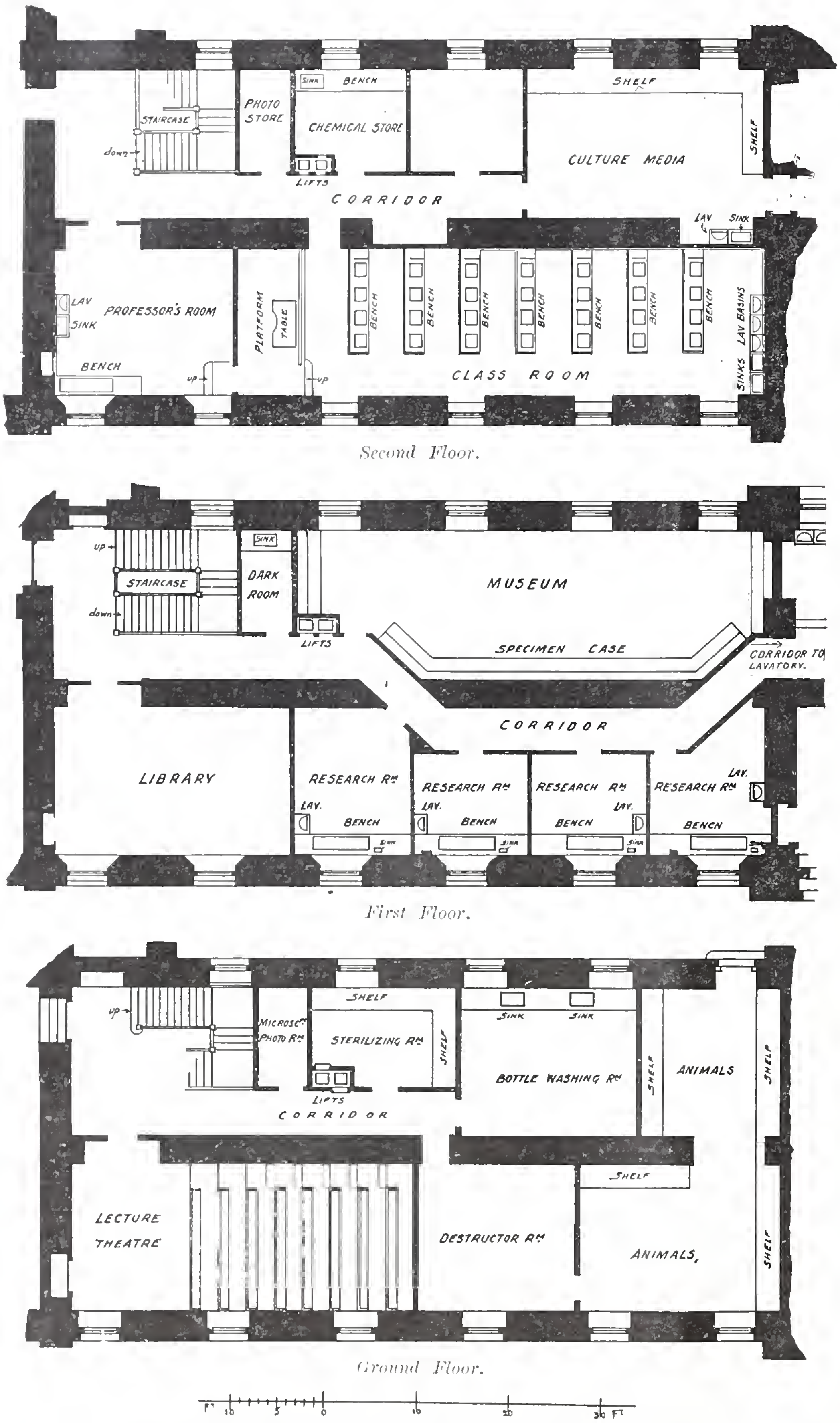
Vaccines.

At the Royal Naval College, Greenwich, there is a teaching school with large laboratories and research rooms attached, which during the war has been the central establishment for the preparation of prophylactic vaccines and the distribution of curative serums to the fleet, the naval service on shore, and especially to the recently established Royal Naval Division and the Royal Naval Air Service. Here, also, most of the examinations of air, water, and food for the service afloat and the various shore dépôts called into being during the last few years have been carried out. During the war more than 2,250 bottles of antisepsis vaccine have been sent from this laboratory to the ships and fighting forces. This in 1914 was supplied by Sir Almroth Wright, but since that time has been manufactured at Greenwich from strains of pyogenic organisms isolated from wounds received in the war. For prophylactic use nearly 6,000 doses of antitetanus serum have been issued, mainly to the Royal Naval Division serving in Gallipoli and in France. During two years anticholera vaccine for more than 50,000 men was supplied to the forces in the Eastern Mediterranean and Persian Gulf, and to the latter a quantity of plague prophylactic was also sent. Since the recognition of dysentery over 2,200 doses of antidysenteric serum have been dispatched for hospital use. At this laboratory and at Malta the greater part of the antityphoid vaccines used in the naval service have been prepared. The laboratories of Chatham, Haslar, Plymouth, and Malta, in which routine examinations of clinical material of all kinds (and also of milk and food, and dressings) are carried on, have had a greatly increased amount of work in the form of systematic examinations, both from a diagnostic and prophylactic point of view, in connexion with infectious diseases.

Antityphoid inoculations of men likely to be exposed to infection have been systematically carried out. In the first year of the war they were inoculated with a typhoid vaccine received from Sir Almroth Wright. When paratyphoid infections became prevalent, a triple vaccine was prepared at Greenwich and Malta containing the typhoid organism and being multivalent for paratyphoid A and B, from strains isolated from cases in the Eastern Mediterranean. It contained the full dose of the typhoid germ and half the number of paratyphoid A and B. A fair degree of immunity, as judged by the agglutination test, was thus produced. The reaction is not excessive and much time and trouble are saved without sacrificing the antityphoid immunizing power. With this more than 40,000 men have received protective inoculations, and by this means the incidence of typhoid among enteric cases in 1916 was reduced from 35 per cent. in the uninoculated to 11 per cent. in the inoculated, or 0.7 per cent. of the total forces in the endemic area, and undoubtedly the severity of the disease was considerably lessened among those who did contract the disease.

Dysentery.

The Royal Naval Division in Gallipoli in 1915 suffered, in common with the other forces on land, from diarrhoea, dysentery, enteric and obscure fevers. The numerous convalescents sent to England were filtered through the large naval hospitals to prevent the escape of any dysenteric or enteric carriers into the general population. The diagnosis on arrival was confirmed or modified by the verdict of the laboratory based on bacteriological, serological, and microscopic investigations. The result of these numerous routine examinations incidentally threw light on the duration and course of the agglutination changes due to the influence of inoculation on the one hand and of definite infection with the enteric group of micro-organisms on the other hand, and thus enabled a more accurate diagnosis to be arrived at in any given case; but it was generally recognized that for certainty of diagnosis the culture of the organism from the blood, faeces, or urine was essential. In the dysentery group of infections the percentage of entamoeba infections found was not very high, but amongst those infected there were some very obstinate carriers, resistant to all forms of emetine. Some vague intestinal symptoms have been traced to such organisms as Morgan I bacillus, and in one instance at least great benefit was derived from vaccine treatment with the organism isolated.



Second Floor.

First Floor.

Ground Floor.

GREENWICH ROYAL NAVAL COLLEGE MEDICAL SCHOOL: PLAN OF QUEEN ANNE BUILDING.

Cerebro-spinal Fever.

In 1915 cerebro-spinal fever became epidemic in England, and during the first year of the war 170 cases of the disease occurred in the navy. Among the various precautions taken to check the spread of this disease, examination of swabs from the naso-pharynx of all new entries was undertaken at the beginning of 1916. At Greenwich alone 5,000 such swabs were examined during the first half of 1916, and of 4,713 cases of healthy non-contacts 46, or 0.976 per cent., were found to be positive, the diagnosis being made on the morphological, cultural, and agglutinative characters. The percentage obtained from contact cases was 5.77. During the winter of 1916–17 up to February, over 4,000 swabs have been examined. From 3,900 non-contact cases there were 112 positive cases, or 2.8 per cent., which is considerably higher than that found in 1915–16. These were all segregated, and thus numerous infective foci were prevented from spreading the disease, which in this district has kept at about the same level as in the preceding year, although more men passed through the dépôt. In 299 instances the organisms isolated were examined by agglutination tests; of these 112 were positive and 187 negative, using the multivalent serum supplied by Flexner as the final criterion. The greater number were again tested by the four univalent strains prepared by Mervyn Gordon; of 82 so examined 36 proved to belong to the type I, 40 to type II, none to type III, and 3 to type IV; 3 did not react to any of Gordon's serums. In the subsequent examination of these carriers 81 per cent. gave no further evidence of infection, partly no doubt as a result of the prophylactic measures employed. During 1916, at the Royal Naval Hospital, Chatham, 7,220 new entries were examined, giving 94, or 0.76 per cent., positive results; among 805 close contacts there were 52 carriers, or 6 per cent., and among 527 remote contacts 6 carriers. At the Royal Naval Hospital, Haslar, among 5,000 new entries examined during January and February, 1917, there were 316, or 6.3 per cent., carriers; whereas among 2,022 new entries examined rather later during 1916—namely, in the spring—there were no positive carriers. This corresponds with the observations at Greenwich, and suggests an "epidemic of carriers." At the Royal Naval Hospital, Plymouth, among 5,220 new entries examined during 1916 there were 117, or 2.2 per cent., carriers, and among 723 contacts 144, or 19.9 per cent., carriers.

By means of this systematic examination of new entries from outside districts the detection and segregation of carriers have been very thorough. During the second year of the war the number of cases of cerebro-spinal fever in the navy declined to 104, although the total strength had greatly increased. This fall in the incidence of the disease, whether entirely correlated with the coincident diminution in the cases of cerebro-spinal fever in the civil and military population, or due to prophylactic measures (quarantine of drafts, examination of contacts and new entries), is eminently satisfactory, especially as out of these 274 cases of cerebro-spinal fever in the navy during the first two years of the war 22, or 8 per cent. only, occurred in sea-going ships. In the second year of the war the serum treatment, which had proved to be a failure in the previous year, was successful; 2,500 doses were issued from Greenwich, and the mortality fell 17 per cent., to 36 per cent. of all cases. This may be largely ascribed to the use of Flexner's multivalent meningococcic serum generously supplied gratuitously by the Rockefeller Institute, New York, and of Mervyn Gordon's various serums, which were not available during the first year of the war.

A number of cases clinically suggesting cerebro-spinal fever (meningismus) occurred, but no confirmation could be obtained by laboratory methods. The cerebro-spinal fluid was clear, though under increased pressure. No organisms were observed microscopically or by culture, and the blood did not contain any antibodies to any meningococcic strains.

Venereal Disease.

In the treatment of venereal disease, which is more in evidence than in most general civil hospitals, the essential intimate association of clinical and laboratory work is well organized. The diagnosis of syphilis by the microscopical detection of the spirochaete in the initial lesion, by the Wassermann reaction of the blood in the later stages, and by the cytological examination and the Wassermann reaction of the cerebro-spinal fluid in luetic lesions of the central nervous system is an established routine in the larger hospitals and laboratories, and the treatment by intravenous injection of arsenical compounds is universally controlled by the examination of the urine for arsenic. During 1916 the total number of Wassermann tests made was 16,766; at Haslar alone during that year 1,833 injections of arsenical compounds were given for syphilis; kharsivan was given on 1,522 occasions, galyl 55, and novo-arseno-billon 256 times.

Protozoal Infections.

As a result of the large number of men serving in tropical and subtropical regions protozoal infections have been frequent. These areas of active operations may be divided into three—(1) the Eastern Mediterranean and Mesopotamia, (2) East Africa, and (3) West Africa.

1. In the Mediterranean area malarial fevers have been most abundant around Salonica where low-lying swampy ground has been chiefly occupied; the disease has been very severe, and mostly of the malignant form caused by the *P. falciparum*, and the clinical aspect has not infrequently suggested enteric, dysentery, or sunstroke. As the infection is unfortunately very resistant to quinine, the most important prophylactic measures are the destruction of mosquitos by drainage and other methods. The largest number of cases in the navy occurred among the Royal Naval Air Service who live on shore. In the Gallipoli area malaria was not common, but short fevers of the dengue or sand-fly type, often described as "Mediterranean dengue," were very frequent. The knowledge that sand-flies are so often the infective agent has enlarged the scope of preventive measures, and a great reduction of these fevers may be expected in the future. Incidentally it is noteworthy that the prophylactic measures strictly enforced against undulant fever have practically eliminated this disease, which ten years ago would have filled the Mediterranean hospitals. This result emphasizes the value of the work done by a well-organized scientific Commission and of the practical application of its recommendations. The occurrence of many cases of beri-beri in the forces in this area proves the importance of an extended study of the food question and other factors concerned in such deficiency diseases.

2. In East Africa the necessity of thorough measures in he prophylactic issue of quinine is most important, as the prevailing type of fever is best controlled by this drug, which should be given both before and during the whole period that men are employed in the endemic area.

3. In West Africa, particularly in the Cameroon area, the varieties and frequency of protozoal and filarial diseases have been very noticeable, and prophylactic measures against them are therefore essential. Of malaria, which is very common, two types are constantly present, quartan and subtertian, the double infection being almost always found in the same case, frequently associated with Calabar swellings and filariae in the blood. In this region tsetse flies are abundant and trypanosome infections have occurred in Europeans. Early search for these parasites is, therefore, most necessary, and appropriate treatment should be given as soon as possible. A case now at Greenwich of over eighteen months' duration shows how persistent treatment can control the disease, for there are practically no symptoms, although the parasite is pathogenic to white rats in eighteen days. The occurrence of mixed blood infections should therefore be suspected; benign and malignant malaria with trypanosomes or filariae have been found together, always associated with a high eosinophilia (up to 50 per cent.). The quartan malarial parasite is most difficult to eradicate and is very resistant to arsenic, recurring in the blood of those with trypanosome infections after a year's treatment with intravenous and intramuscular injections of antimony and arsenic.

No case of small-pox has been recorded in the navy during the period of the war, thus proving the value of vaccination, which has been compulsory since about 1858.

SURGERY.

BY

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AND

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The equipment of naval hospitals and their treatment of the wounded are on the same lines as in the best British and Continental institutions. If Haslar be taken as an example, the critical visitor would see that all cases of bacteriological importance are diagnosed and treated in association with a perfectly equipped laboratory, in which discharges are stained, cultures are made from blood and wound discharges, vaccines are prepared, and sections are cut of tissues removed from the body for the purpose of microscopical examination. Hence it is needless to point out further how great is the importance attached to the relation between the laboratory and the treatment of surgical disease in this hospital.

Treatment of Wounds Received in War.

The whole question of aseptic and antiseptic treatment has been revised and judgements passed upon the different methods of accomplishing each branch. On the whole, authorities are not satisfied with the aseptic treatment of these wounds. Although it appears successful in some cases, it fails too often in others to encourage its general use. The hypertonic salt solution has been given complete trial, with the result just stated. Wounds undergoing this treatment are liable to secondary or mixed infections. At one time the wounds in one of the wards at Haslar became secondarily infected with *B. pyocyaneus*; the appearance of this micro-organism was at once detected, and it soon disappeared by substituting the antiseptic for the aseptic method. Secondary infections very rarely occur in efficient antiseptic treatment.

In the early part of the war an investigation was carried out in the laboratories of Greenwich and Chatham Hospitals as to the best methods of treating war wounds with various antiseptics.[1] The real problem was to find a diffusible substance which could be applied at, or as shortly as possible after, the time of infliction, and which would inhibit bacterial growth until thorough disinfection and cleansing could be effected at a field hospital. Of the various substances tested, cresol and salicylic acid produced the best results, and appeared to be the most useful for the purpose required. A cresol paste (20 per cent. in lanolin and wax base) and a powder containing equal parts of boric and salicylic acids ("borsal") were introduced. These had given excellent results in laboratory infections, but met with less success in cases from the front, on account of the difficulties of time and places incident to war conditions. Successful cases have been reported from the Gallipoli campaign in which the treatment was adopted, severe gunshot and shell wounds remaining free from suppuration and healing readily.[2] That a cresol or carbolic acid paste is a valuable treatment for wounds on board ship is shown in a report on various cases so treated in a battleship,[3] and wounds, including compound fractures, treated in Chatham Hospital by carbolic acid cleansing and liberal introduction of cresol paste healed well without suppuration.

At Haslar a "green spray" composed of equal parts of 2 per cent. malachite green dissolved in 80 per cent. rectified spirit and water, and 2 per cent. perchloride of mercury dissolved in 80 per cent. rectified spirit and water, has proved satisfactory. It is advisable to keep the two solutions separate, unless the antiseptic mixture is in constant use. The mixture contains 1 per cent. each of malachite green and mercuric chloride in the form of a compound—$C_{23}H_{25}N_2Cl_4$ (Micklethwait)—each molecule of malachite green combining with two of mercury. The compound is easily dissociated, and when it comes in contact with the tissues probably forms an albuminate of mercury and an albuminate of malachite green. The malachite green is reduced by living tissues to the leuco-compound, and therefore becomes invisible in a wound but still maintains its activity. Sloughs and necrosed tissues do not reduce the stain. The albuminate of mercury remains in the wounds as a dépôt, and is slowly dissolved by the exudates, and then exerts its antiseptic action. The bacteriological work on which the use of this compound is based and satisfactory clinical results were published in 1915.[1] The mixture is non-toxic and can be applied to mucous membrane. It is a trustworthy germicide for sterilizing the skin before operations, and is applied by means of a spray. As it stains the skin green the area so treated is clearly marked out. When applied to septic wounds it practically stops secondary infection and steadily diminishes the number of pre-existing micro-organisms. Its value has also been proved in osteomyelitis, septic compound fractures, burns, ulcers, boils, and carbuncles.

The treatment of infected war wounds by physiological methods was inaugurated by Colonel Sir Almroth Wright, who introduced the physiological saline solution (0.85 per cent. sodium chloride) and the hypertonic solution containing 5 per cent. of the salt. He argues that the hypertonic solution inhibits and arrests bacterial growth, produces a lymphagogic action, and sets free a tryptic ferment for the digestive cleansing of the wound. Dressings should be applied warm, very wet, and covered with an impermeable tissue. If the position of the wound render it practicable, immersion in a 5 per cent. saline bath is the best procedure. The bath should be intermittent to allow of the alternating lymphagogic and digestive cleansing action. Normal saline dressing is used in the intervals. Extensive lacerated wounds with fracture caused by shell or bomb have more recently been packed with salt tablets wrapped in gauze folds, the whole being covered with jaconet. This dressing, which usually causes pain for some hours, can be left for two or three days provided the outer covering is moist with discharge, showing that lymph flow is active.

The use of hypochlorous acid as an antiseptic has come into prominence during the war, and chiefly in the form of eusol—a solution containing approximately 0.5 per cent. of the acid—has been extensively employed in naval hospitals. It is a powerful germicidal agent as proved by laboratory experiments, is non-toxic to the tissues, and being gaseous penetrates deeply to all parts of the wound. The solution of hypochlorite of sodium, 0.5 to 0.6 per cent., introduced by Dakin and Carrel is also in use together with the special method of injection tubes and light gauze packing to ensure contact of the fluid with the whole surface of the wound. Good results have been obtained from this treatment, the wounds cleaning quickly and a healthy granulating action appears. If employed for a long period both solutions have in a few cases produced oedema and irritation of skin. This can be prevented by vaseline smears.

The clinical results obtained by the use of a bismuth, iodoform, and paraffin paste[5] in septic wounds, including compound fractures, has led to its employment in the naval hospitals with encouraging results. Though a less powerful and less soluble antiseptic agent than the hypochlorites, observation has shown that it maintains a continuous antiseptic action in the wound. It excites a free exudation of serum, and granulation tissue grows freely in contact with it. The wound after thorough cleansing is swabbed with ether or rectified spirit, a little of the paste is rubbed into the tissues, a thin layer being left in the deeper parts, and a gauze dressing applied. The dressing can be left on and the wound undisturbed for seven days or longer. This is an advantage, especially in compound fractures; it saves labour, dressings, and much distress to patients. Drainage tubes are not required, as the paste does not prevent the escape of discharge. The constituents are toxic if freely absorbed; the quantity used, therefore, should not exceed two drachms.

At Haslar successful drainage of wounds has been obtained with a four-way drainage rubber staff, which in transverse section is a cross.[6] It overcomes the accumulation of discharge which occurs in a tube if the opening be not dependent. When using the four-way staff the pressure exerted by the contraction of surrounding tissues is directed upon the discharges, which are forced out. With regard to the dressing applied to septic wounds generally, constant and repeated change is always the practice.

Burns.

Hitherto picric acid as a first dressing has been unrivalled, and septic burns treated by hot saline baths and boric fomentations, followed by a mildly antiseptic ointment of soft consistence, have healed readily and well. Médecin-major Barthe de Sandfort's "ambrine" treatment (vide p. 540) is now under trial.

Equipment.

For the treatment of the after-effects of severe injuries such as stiff joints, atrophied musculature, and nerve lesions, the naval hospitals are fully equipped. Surgical gymnasiums have been established and fitted with medico-mechanical apparatus to aid in the restoration of articular and muscular function. The forms of apparatus were designed to carry out by mechanical means the various movements and manipulations of the Swedish system of physical exercises, and include a combination weight and pulley apparatus—stationary bicycle—apparatus for foot circumduction, knee and foot flexion and extension, elbow pendulum with shoulder extension, frictional wrist machine, finger machine, shoulder circling movements, etc. The machinery can be set at any desired resistance by the aid of graduated levers and adjustable weights. For impaired articular movement radiant heat treatment (solarium bath) is also employed. Electrically the interrupted and continuous current in its various forms is in use, as well as the high frequency current, including diathermy. The system of testing muscle reaction by condenser discharges has been adopted. Ionization is practised extensively in a great number of injuries, and has been found particularly useful in obstinate healing wounds and in relaxing scar tissue. An excellent and complete *x*-ray apparatus is in use, with improved means for the localization of foreign bodies. All of the most recently invented splints are also available. Hey Groves's instruments for inducing and maintaining correct adjustments in fractured bones are in use.

The Wildey hypodermic syringe, designed by Deputy Surgeon-General A. G. Wildey, R.N., has been used with great satisfaction both in naval actions and in the field. The syringe with needle fixed is fitted into a metal sheath with safety-pin attachment by which it can be fastened to the coat and thus be readily available at any moment. The sheath, which can be quickly removed and replaced, protects it from dust and dirt. A spare needle fits neatly into the hollow piston. The syringe is used in conjunction with a solution bottle fitted with rubber cap, through which the needle is passed and the syringe rapidly charged.

The assistance afforded by accurately applied pressure in tourniquet work is shown by a metal tourniquet designed in Haslar.[7] The freedom and simplicity with which its pressure can be increased or diminished with delicacy should encourage a more constant use of the tourniquet without fear of damage to tissues or of oozing of blood after the operations. Its advantages are best displayed during operations upon cases of traumatic aneurysm, aneurysmal varix, and varicose aneurysms. A rubber tourniquet is difficult to apply and remove, and when applied its pressure is greater than required and maintained longer than necessary. These drawbacks are abolished by the use of this new metal tourniquet.

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HYGIENE.

By Fleet Surgeon R. C. Munday, R.N.

Just as the fighting service of the navy was found, at the outbreak of war, prepared at all points for any emergency, so also the medical service of the navy stood equipped with every weapon that modern sanitary science could suggest. In August, 1914, many eminent combatant naval officers were of opinion that the numerous and far-reaching precautions for safeguarding and fostering the health of the personnel would to a great extent have to be abandoned in the face of the pressing exigencies of modern warfare. It was also generally thought that the war would probably be of short duration, and that many conditions of life which, if long continued, would be detrimental to health, could and indeed must be endured for a few months. The Director-General of the Naval Medical Department, however, has from the outset always maintained that the objects to be kept constantly in view are to keep as many officers and men as possible in the highest state of fighting efficiency, and to reduce the loss of service from sickness to a minimum. It was evident also that the means to this end were constant supervision of the daily life of the personnel and the continuous adoption in practice of measures born of modern research. As a result of this doctrine, the war, instead of producing a reduction or relaxation of the requirements of modern sanitation, brought with it a great speeding up of hygienic vigilance, together with progressive improvement in the appliances and apparatus employed in preventive medicine throughout the naval service, not only afloat but also in our many shore establishments. Combatant officers and local administrators who were at first sceptical of or even strongly opposed to activity in such directions have come to see the military advantages accruing therefrom, and now demand the maintenance of a high standard of hygiene. That success, beyond anything the most optimistic prophet could have foretold, has attended the efforts made by the Naval Medical Service is evident from the extraordinarily small loss of service from sickness in the navy, in the dockyards, and in the Admiralty munition factories; moreover, the well established fighting efficiency of our sailors and aviators points in the same direction.

Ventilation.

The improvements in our warships since hostilities commenced are perhaps more pronounced in the matter of ventilation than in any other branch of hygiene. These improvements are the outcome of recommendations made by a committee appointed by the Admiralty at the end of 1912 to investigate and report on the best methods of ventilating modern warships. The Admiralty were moved to this step by certain observations recorded at a series of conferences of naval and civilian medical men summoned in 1910 to consider and report on the causes and effects of tuberculosis in the navy.

In March, 1913, a First Interim Report was submitted by the Committee to the Admiralty, making certain urgent recommendations of a constructional nature; and as a result of these representations a definite minimum standard—200 cub. ft.—of individual cubic space for sleeping places was laid down, and a uniform minimum fan supply of 3,000 cub. ft. of air per hour per man was arranged for all sleeping and all ordinary working and living spaces. The position of various ventilators on the weather deck was so arranged as to ensure a continuous supply of pure air under all conditions of weather and sea. The undesirable position also of certain alternative intakes between decks was abolished and methods of improvement in this respect were inaugurated. The Committee considered that a powerful exhaust effect from the engine room and stokehold ventilation was available for use on the mess decks when required; but as a general rule they strongly recommended, and the Admiralty adopted, the plenum system combined with natural exhaust for living spaces, and the fan exhaust system with natural supply for spaces in which are generated disagreeable odours, great heat, water vapour, or deleterious gases; but it was specifically stated that no fan supply should be fitted for the ventilation of such places. Silent-running fans, means for avoidance of draughts, arrangements for accessibility of the interior of air trunks for cleaning purposes, and the fine adjustment of, and protection from unauthorized tampering with, air-warming appliances are now fitted in all new ships. Formerly improvement in the ventilation and drainage of bathrooms was urgently needed, and at the suggestion of the Committee special innovations were introduced by which the atmosphere in these places was rendered purer and at the same time prevented from pervading the living spaces. Lastly, the inadequate electric lighting of midshipmen's studies and of departmental offices was corrected, a 3 ft. candle illumination on the desks being so arranged that the light passes over the left shoulder of the person reading or writing; now also offices in which persons are working most of the day are placed where natural light and ventilation are available. Not only did the Admiralty order the recommendations to be embodied in the designs of all new ships, but they also gave instructions that so far as was feasible completed ships should be brought into line with the Committee's pronouncements, and during the war, as the older ships have come into dockyard hands for a refit, their ventilation and sanitation has been brought up to date.

In April, 1913, a Second Interim Report was published, dealing chiefly with administrative matters, and in accordance with the Committee's suggestions a senior medical officer was appointed as an additional member of the staff of the Medical Director-General to assist the Director of Naval Construction in the consideration of all plans and details of fittings in connexion with ventilation and hygiene of ships building, all such plans being referred to the Medical Director-General's department for that purpose before final approval was given. This medical officer was also placed at the disposal of the Director of Naval Equipment in the event of his requiring expert advice on any point of naval hygiene, and the former now inspects the hygienic arrangements, including ventilation, in ships building as they approach completion, so as to avoid as far as possible any necessary alterations when the ships are completed; he also co-operates with the above departments in dealing with proposed alterations and improvements in the ventilation and sanitation of ships already built.

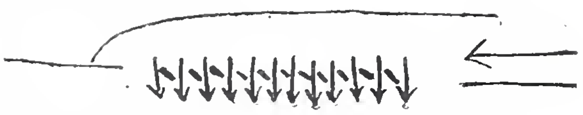
Further, there is on board every ship one commissioned officer responsible to the captain for the general supervision and the best use of the means available for the ventilation of the ship; and whether, in every case, the senior medical officer be actually employed on this duty or not he is at least always in close touch with the officer detailed for it, and is now recognized as the official expert on matters of ventilation and hygiene generally. Moreover, every ship now has a well-organized ventilation party for the management of the ventilation appliances under the orders of the ventilation officer. The medical officers also give lectures on board ship to officers and men on elementary hygiene, with especial reference to ventilation; assistant constructors going through a course at Greenwich College attend the lectures on naval hygiene given at the medical school there, and medical officers under instruction at Greenwich are taught the construction of fans, how to read plans of ventilation, and the considerations governing the volume and velocity of air passing through trunks, ducts, etc.

As affording a good index of the efficiency of the means of ventilation, regular observations of wet and dry bulb temperatures in living and working spaces are made by medical officers afloat, and samples of air are taken in compartments where the ventilation seems unsatisfactory. These samples are sent to Greenwich College for analysis and report in duplicate, one copy being forwarded to the ship and the other to the Medical Department for the information of the Director-General, and to enable him to keep in touch with the requirements of ship ventilation. Every ship also now submits a quarterly report, signed by the captain, showing what means of ventilation and warming have been in use, the extent of the supervision exercised, records of wet and dry bulb temperatures taken in living spaces, and results of analyses of air, together with any recommendations for improvement.

The Final Report of the Ventilation Committee was issued in March, 1914, and contained *inter alia* a proposal for a new system of trunking, devised, after a long series of experiments at Portsmouth Dockyard, to overcome the disadvantages of previous systems by which intolerable draughts were produced and air and warmth were distributed in a most uneven manner throughout the living paces.

The principle of the new system which has now been adopted in our most recent battleships and cruisers is that by means of an adjusted deflector projecting into the air duct a limited flow of air is directed into a large number of outlet gratings.

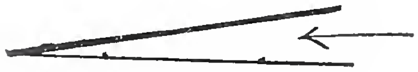
It was found that with a suitable but very simple and inexpensive form of grating the air passes out through it with a fairly uniform velocity at all parts. As, however, the area of the grating is considerable in proportion to the air allowed to issue through it, the velocity of the issuing air is low, and no unpleasant draught is perceptible at more than a foot away even when 100 cubic feet of air a minute are issuing from a grating of 18 by 6 inches. The grating is made of expanded steel, and it was found that a three-eighths of an inch mesh placed so that its direction tended to deflect the air at right angles to the trunk thus :



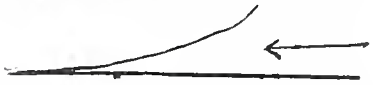
produced the best effect at a minimum of cost and weight. An endeavour was then made by varying the curvature of the deflector to obviate the inequality of distribution over the face of the grating, and experiments were made with deflectors :

(a) Concave, thus :

(b) Straight, thus :



(c) Convex, thus :



The distribution of the air was found to be a function of (1) the velocity of the air in the trunk flowing past the deflector ; (2) the amount of opening of the deflector; (3) the shape of the deflector.

On the whole, the straight deflector proved to be the most satisfactory and was adopted in all subsequent experiments ; and for gratings in the proximal end of the trunk nearest to the fan, where the velocities are high and the angle of opening of the deflector small, the straightness and truth of the deflector is of great importance.

As each deflector takes off a portion of the air flowing along a uniform trunk the velocity of air flow in the trunk beyond is correspondingly diminished ; and since frictional resistance varies as the square of the velocity, there is a very marked reduction in frictional resistance. So important is this effect, that it was found that with a sufficient number of deflectors and gratings distributed along the sides of a uniform trunk of sufficient length the volume of air delivered was 93 per cent. of the delivery when no trunk at all was connected with the delivery side of the fan, there being, however, a trunk of about the ordinary length and size on the intake side, as would always be the case in a ship.

The deflectors themselves cause no material resistance. There is no difficulty in fixing them so that each gives practically the same delivery of air, a simple formula having been found by means of which this can be done without actual trial. The deflectors remote from the fan, where the velocity and pressure of the air in the trunk are small, require, of course, to be much more widely open than those close to the fan. Suppose the number of deflectors in a trunk is N, then the amount of opening of the Rth deflector will be $\frac{1}{N - R + 1}$ multiplied by the width of the trunk ; thus, for example, the last must be full open, the last but one half open, and so on.

In a new ship the deflectors are first adjusted in accordance with the above formula, and then with the fan running under ordinary conditions each delivery opening is examined to see whether the velocity of air current is approximately the same at any portion of the trunk proximal or distal, and the deflectors are adjusted until this has been attained ; but once equality of velocity has been secured the deflectors should be permanently fixed so that unauthorized persons shall not tamper with them and cause too great a draught in one place and a lack of air in another.

In the case of branch pipes it was found best to place a deflector at the junction and so control the delivery through the whole of the gratings on the branch. Each grating on the branch should also have its deflector. It was also found that it made no measurable difference to the amount of air distributed whether the branches came off at right angles or at the usual angle of 30 degrees.

If each grating measures 18 by 6 inches, which appears to be a convenient size, one is required for every two men when 50 cubic feet of air per man per minute is supplied. This. of course, means a considerable number of gratings. On the other hand, the arrangement is simple, inexpensive, and efficient in preventing draughts and distributing air and warmth evenly throughout a compartment. Very favourable reports have been received from all ships so fitted.

Another great improvement effected during the war as a result of the Committee's recommendation is the introduction of a water-excluding ventilator, which is a modification of a fitting observed by the Committee in the French battleship *Courbet.*

Important compartments in the forward end of the ship, such as the seamen's latrines and the sick bay, both of which require specially good ventilation, were formerly entirely without it at sea, except in the calmest weather, simply because both the natural and artificial ventilation had to be closed to keep the water out. Now, however, the new fitting, by a combination of centrifugal action and drainage. guides any water which enters the ventilator back to the deck without permitting any of it to enter the fan or trunks. Consequently every compartment in the latest ships is just as well ventilated in the roughest weather at sea as it is in smooth weather.

Much, too, has been done to reduce the heat and stagnation of air in certain important compartments near the boiler rooms by the introduction of the traversing type of open propeller fan with the object of stirring up the air in accordance with Leonard Hill's results.

In 1915 the condition of living spaces during the long hours in which the ports and all means of natural ventilation have to be closed to exclude light came under consideration, and a number of light-excluding scuttle ventilators was supplied to every ship.

Special attention has been paid in the ships built during the war to the positions and ventilation of wireless offices, transmitting stations (which are the chief nerve ganglia in a ship), and to the space appropriated for treatment of the wounded during action, so that the atmosphere in each of them may be cool and fresh. Gunhouses and the silent cabinets in gunhouses have within the past twelve months been fitted with artificial ventilation which has been very favourably reported on by the Gunnery School at Whale Island. Destroyers are now fitted with pressure ventilating fans and the indirect system of heating the mess decks.

The ventilation of, and the method of purification of, the air in submarines have been greatly improved since the outbreak of war, and this is very clearly shown by the enormous reduction in the CO_2 content after long hours of diving. Traversing fans have been introduced into these vessels also.

Water Supply.

Before the war practically all drinking water consumed in ships in commission was distilled by their own condensers. but, for military reasons, a very large number of the smaller vessels and a few of the larger have, during the present hostilities, derived their water supply from the shore through the medium of water-carrying vessels, varying in size from small water boats of about 100 tons to large colliers. It was obvious from the commencement of this system that the transit from the standpipe on shore to the drinking tank in H.M. ships by way of hoses and tanks in water carrying vessels would be attended by a good deal of pollution, unless special precautions were taken, and even then some risk would be unavoidable ; accordingly, the Admiralty issued orders that the work of cleaning tanks was in all ships to be carried out under medical supervision ; that the clothing, including footwear, of the men who actually enter the tank was always to be previously disinfected ; and that the work must be done by the ship, not by contractors, so that the men who carried it out could be under immediate control and supervision. Moreover, the process of supplying drinking water from standpipes on shore to tank vessels has for the past twelve months been under the supervision of naval medical officers, who draw up a few simple rules for the guidance of the men in charge of standpipes and for the masters of tank vessels. These rules are posted near the standpipes and in prominent positions in the tank vessels. Similarly the process of receiving water from a tank vessel into one of H.M. ships is always under the supervision of the medical officer of that ship or her parent ship, who sterilizes the water with chloride of lime, however pure the source of the supply may be.

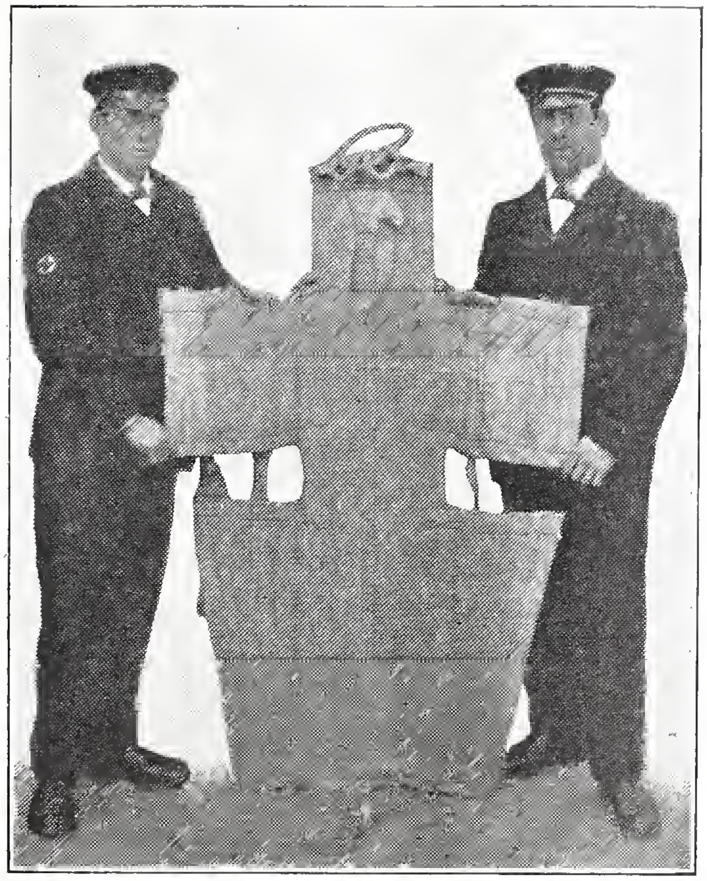


FIG. 1.—Neil Robertson Stretcher Open.

Further, a special naval medical officer is employed in the sole duty of seeing that every precaution possible is taken to safeguard the water from pollution during its transit from shore standpipes to ship's tanks. He travels from port to port inspecting the water-carrying vessels to see that their fittings are in accordance with hygienic requirements and that the method of transferring the water is in accordance with the rules laid down by the Medical Department.

During the Gallipoli campaign a distilling apparatus of great capacity was set up in Mudros in order to provide the ships and the Naval Division with an ample supply of pure water.

As the sites of air stations have been selected primarily from a fighting point of view, the water supply, both as regards quantity and quality, has often proved a matter of difficulty and anxious consideration; it has then been necessary to arrange for sterilization by chlorination.

Unhealthy Occupations.

The composition used for the preservation of the fabric of aeroplanes contains material which, in civilian factories, has given rise to many cases of toxic jaundice, some of which have proved fatal. Although the Naval Air Service has used a very large amount of this "dope" no deaths, nor, indeed, any cases of illness entailing loss of service for a single day, have occurred. This fortunate result is to be attributed to widely disseminated information among the personnel as to the danger to be guarded against, efficient artificial exhaust arrangements (giving thirty changes of air per hour in doping rooms) and complete organization for extensive alternation of work.

The "dope" used in varnishing air-ship envelopes is of an entirely different nature, and in the absence of protective measures causes symptoms resembling acute alcoholism; but here again, although several hundreds of men are employed continuously at this work no ill effects can be traced to it owing to the efficient methods of immediately removing the fumes by a large number of powerful exhaust fans.

In our munition factories 5,000 men and women handle tri-nitro-toluene (T.N.T.), but no dust is allowed to collect, and the regulations for the protection of workers have been so strictly carried out that not only have there been no fatal cases, but there is no record of a single case of toxic jaundice. Although many authorities believe that the poisonous agent in T.N.T. is introduced through the skin, it is considered unjustifiable to allow the fumes of melting T.N.T. to escape into the general atmosphere of the room, and in all our factories artificial exhaust arrangements have been fitted to remove the fumes from their point of origin.

THE SERVICE AFLOAT.

BY

Deputy Surgeon-General ROBERT HILL, C.V.O.,
Principal Medical Officer, Grand Fleet,
AND
Fleet Surgeon E. A. PENFOLD, D.S.O., M.B., R.N.

ALL senior medical officers afloat of the Royal Navy appreciate the work of preparation which has been steadily going on for many years, most markedly in the last decade, in the Service. The plans laid down in peace time for the rapid expansion, when war should be declared, in personnel and stores, all bore fruit when put to the test in 1914, and this expansion still continues.

The installation about six years ago of high-pressure steam disinfectors in ships has, since the outbreak of war, proved of supreme value. Besides providing a weapon to combat the exanthemata and other infectious diseases as well as scabies, they sterilize clothing and dressings as frequently as may be desired. Another great improvement of pre-war times was the replacement of the clumsy service stretcher by the two forms of stretcher now in general use—(1) the bamboo stretcher designed from the Japanese stretcher by the late Fleet Surgeon Neil Robertson, R.N. (Figs. 1 and 2), which renders possible the removal of wounded from small compartments, down escapes in turrets, and round difficult corners with a minimum of danger and discomfort, and (2) the ambulance field service stretcher (Fig. 3), which enters so largely into the scheme for increased stowage space by the tier system, as explained further on (Figs. 4, 5, and 6).

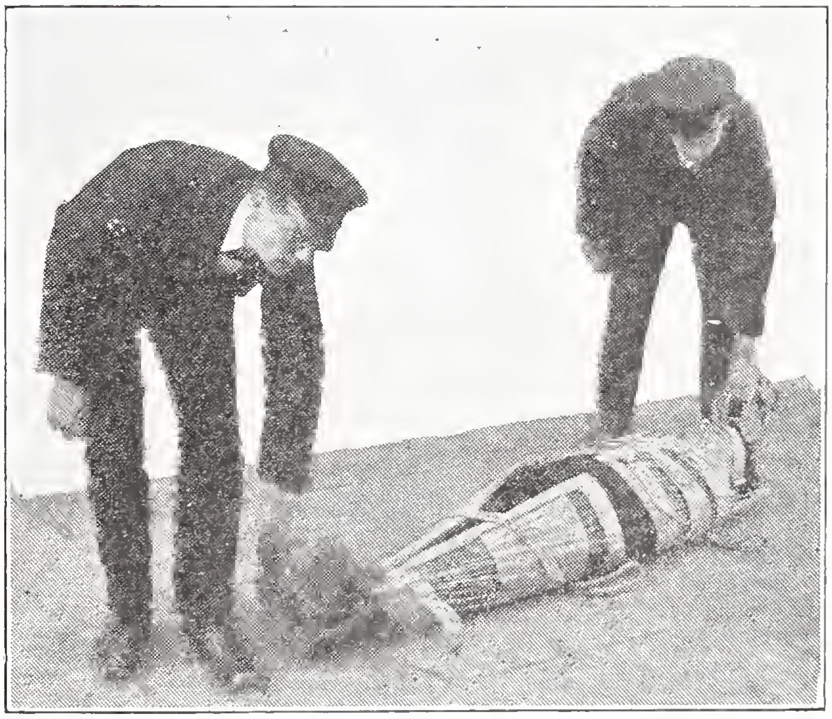


FIG. 2.—Neil Robertson Stretcher with Patient.

At the outbreak of war the supply of stores and instruments increased automatically, and catgut, silk, and the like were sent to ships in portable tubes ready sterilized. The ships have always been on a war footing, but much has been learnt since the start of hostilities, notably the large number and severity of burns encountered in action. Pictures of bluejackets working their guns stripped to the waist are picturesque reminiscences of the past, but the battle of Jutland showed that exposed parts, such as face, neck, hands, and arms, are very liable to be severely burnt.

For the evolution of the anti-gas apparatus thanks are due to Fleet Surgeon D. W. Hewitt, R.N., and Mr. A. Hutchinson, of Pembroke College, Cambridge. Their work goes to prove that the naval medical authorities are keeping pace with and countering the fresh devices of the enemy in this respect.

Burns.

The paraffin, or "ambrine," treatment of burns introduced by Médecin-major Barthe de Sandfort of Paris (late of the French navy) has been adopted by the Naval Medical Service afloat. A small slab of the wax, which is a mixture of paraffin and resins, is put into a metal spray producer and heated, either over a spirit lamp or in a water bath, up to the temperature when the wax melts. The bellows of the spray producer are then adjusted, and the liquid wax is pumped as a very fine spray on to the burnt surface, which has been previously dried thoroughly. A cake of wax forms over the surface, and is both airproof and, from the heat at which it is applied, aseptic. A thin layer of cotton-wool is then laid on this wax, and the whole is again covered with the liquid wax applied by a brush. The results are very satisfactory; pain is certainly relieved rapidly, and subsequent dressings are almost painless.

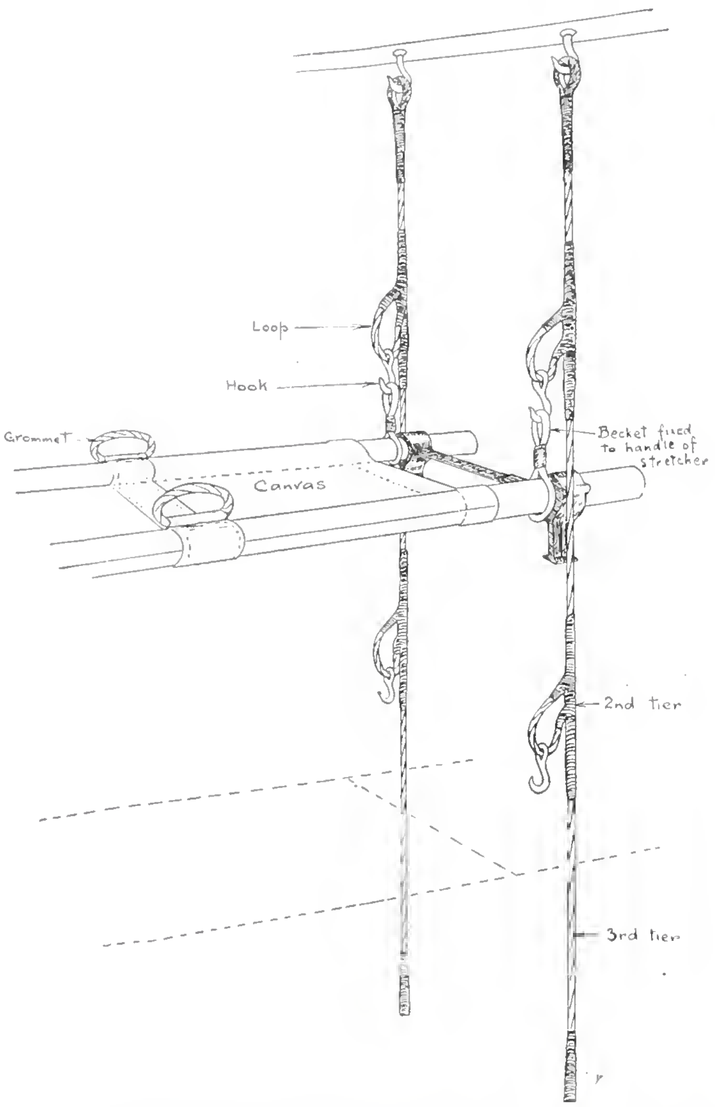


FIG. 3.—Bamboo "field" stretcher slung from wire roping in tier of three system. Design adopted by the Admiralty.

Caisson Disease.

Another valuable adjunct to the medical service is the compression chamber fitted in one of the base ships for cases showing signs of caisson disease. It has proved very useful in the few cases in which it has been necessary to use it.

Dentistry.

The appointment of dental surgeons to certain ships in the Grand Fleet has been very valuable. Their services became necessary owing to the few opportunities which men had to visit the dental surgeons at the bases. The amount of work they have accomplished has proved of infinite benefit to the comfort and well-being of all hands.

Sick Bays

The evolution of the sick bays from those of twenty years ago has advanced as rapidly as that of the ships themselves, and they are now well equipped. Situated well forward, the sick bay usually occupies the whole beam of the ship, and thus gets the advantage of scuttles on both sides for light and air. It is also ventilated by trunks from the upper deck, and this is of inestimable advantage when battened down at sea. The swinging cots, from eight to twelve in number, are slung on supports in the main portion of the bay, and arranged in two tiers with room between each group to nurse on both sides. There is also room for a few hammocks. The messing room is usually curtained off from the beds. The operating room is an excellent compartment with tiled floor, good light from both scuttles and electric groups, enamelled iron shelves, tables, and wash bowls, electric wandering lead and serviceable operating table. The supply of instruments comprises a major operating case, a minor operating case, a case of eye instruments, a set of silver catheters, Potain's aspirator, a small dental outfit, a sterilizer, splints, irrigators, etc. The dispensary is well lighted and fitted up. In some of the newer ships a separate mess is provided for the sick berth staff. This is a great advance and much needed accommodation. There is also an isolation cabin, usually with two beds, which can be used as a junior officers' hospital.

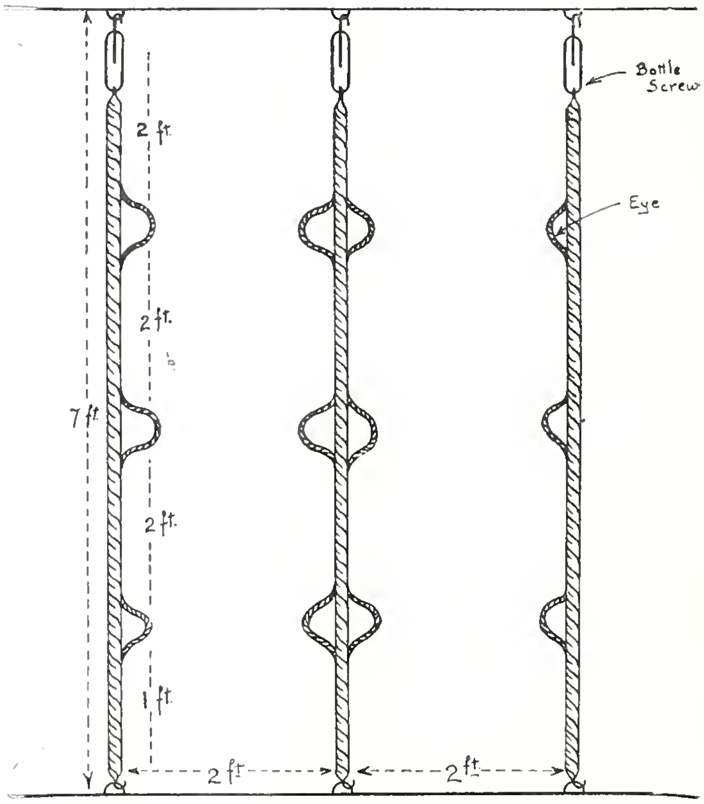


FIG. 4.—Wire-rope uprights in position for reception of cots or stretchers. Designed by Staff Surgeon Bringan, R.N., in H.M.S. *Edgar*.

In order to obtain all the advantages as regards space, light, and air, the sick bay must be situated in an unprotected part of the ship. This subject is closely connected with that of the accommodation for the sick and wounded and the medical staff during an action, and also after it, as the sick bay itself is likely to be shattered.

Distributing (Dressing) Stations.

In all modern ships there are two distributing stations designed in the construction of the ship, where the medical officers and their assistants are stationed in action; these are usually situated one in the fore part and one in the after part of the ship. They are designed so that they shall be, as far as possible, in the most protected parts of the ship, and for this reason there are many difficulties as regards space, ventilation, and temperature, these dressing stations being usually in close vicinity to boiler rooms or other engine-room compartments, which are necessarily in the most heavily armoured parts of the ship, and are usually hot and the space limited. They are nowadays fitted permanently as dressing stations, with operating tables, shelves, cupboards, and other appliances, and are kept always ready in war time, so that when the ship prepares for "immediate action" only those stores, instruments, dressings, and so forth which are in daily use in the sick bay proper are removed to these stations.

Stowage of Wounded.

The stowage of wounded in the limited space available under armour has exercised the minds of naval medical officers for many years, and active service quickly demonstrated that the decks became too wet to be desirable or comfortable for the wounded; further, very few cots and stretchers could be accommodated in the space at our disposal. Much ingenuity has been displayed by various officers to increase this cot accommodation—Fleet Surgeon Lavertine, Staff Surgeon Bringan, and the late Fleet Surgeon Capps. In all their designs the tier system has been adopted. The two chief types produced are (*a*) the rigid wooden skeleton to hold cots or stretchers, and (*b*) wire roping, fitted with loops at intervals of 2 ft. to carry the stretcher, fixed to the beam above, and either fixed to the deck below or allowed to swing clear.

The committee appointed to report on accommodation of wounded decided on the wire-roping system, erected in single tiers for three stretchers, as the most useful. Figures 3, 4, 5, 6 show the different designs. This contrivance, rigged near the distributing station on both sides of the main deck, and in other suitable sites, increases the stowage room threefold—keeps the wounded off the wet deck, and places them in situations from which they can be easily attended to and moved should the disengaged side become the engaged one.

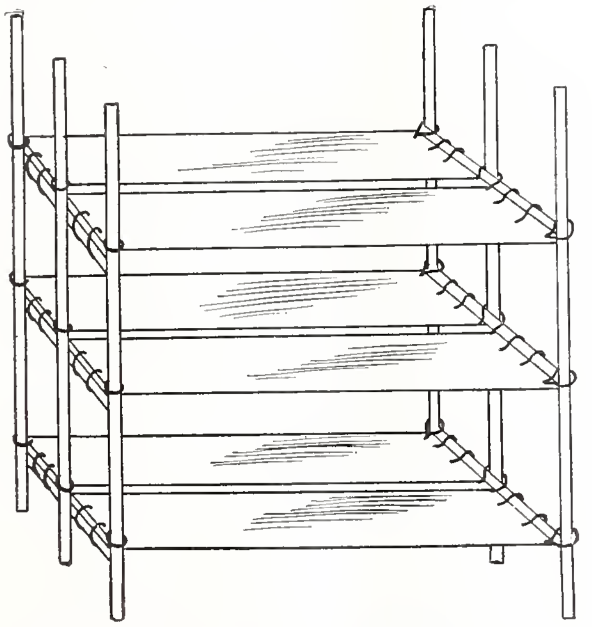


FIG. 5.—Representing a group of six cots in position. Designed by Staff Surgeon Bringan in H.M.S. *Edgar*.

First Aid.

Besides the "first-aid" haversacks, boxes or cupboards for each gun are filled with single packages of dressings and other appliances, according to each medical officer's plan. Similar haversacks are usually supplied for the leading hands in charge of each stretcher party, and for every isolated position in the ship—that is, for each station in action where a number of men are isolated in various compartments such as conning tower, torpedo flats, gunnery and torpedo control positions, workshops, repair parties, engine rooms. The "first-aid" dressings supplied to these stations vary in amount according to the number of men stationed there, which may be from three to fifty men. It is also usual to have large tin boxes of additional dressings, tourniquets, scissors, splints, and other appliances in various accessible parts of the ship during action. These stores are used when there is any lull in the fighting, to replenish the haversacks or small boxes belonging to the guns and other stations without the necessity of coming to the medical officers in their usually distant stations.

It must be borne in mind that owing to the condition of a ship during and after an action, and to the excessive shock, even in the less severe cases of injury, it is advisable to avoid immediate operations.

Shock.

In order to combat shock the hypodermic injection of morphine is one of the most important duties of the medical officers during action, as this cannot be satisfactorily carried out by the best of lay assistants who have not previously been accustomed to it. No other forms of administration are entirely satisfactory, although commanding officers of destroyers in the early days of the war, when they were frequently in action, and before the appointment of surgeon probationers, had great faith in the small opium tablets with which they were supplied.

Sepsis.

The next most important duty in action is to combat sepsis, and although there is no soil contamination to be fought against, the wounds caused by shell are contaminated by all sorts of débris, resulting from shell explosion in a confined space, and the difficulties in the way of cleaning the wounds are greatly increased if the hot water supply in the dressing stations has been cut off either by explosion there, or by destruction of the fresh water supply pipes in other parts of the ship. Recourse must then be had to the previously prepared stock of lotions and to iodine and rectified spirit. After combating shock and cleansing wounds, first dressings are applied and the patients made as comfortable as possible. After the action is over, or if there is a lull, it may be possible to do more in the way of surgery, but as the action may be resumed at any moment until the ship is outside the "danger zone," there will not be any time during which the ship is not liable to attack from the enemy, either by gunfire, torpedo, mines, or from the air, so that usually all that can be done is to remove the wounded to places previously arranged for, in all possible "protected" places, where their wounds can be redressed more carefully and splints applied to fractured limbs, and any immediate surgical work carried out.

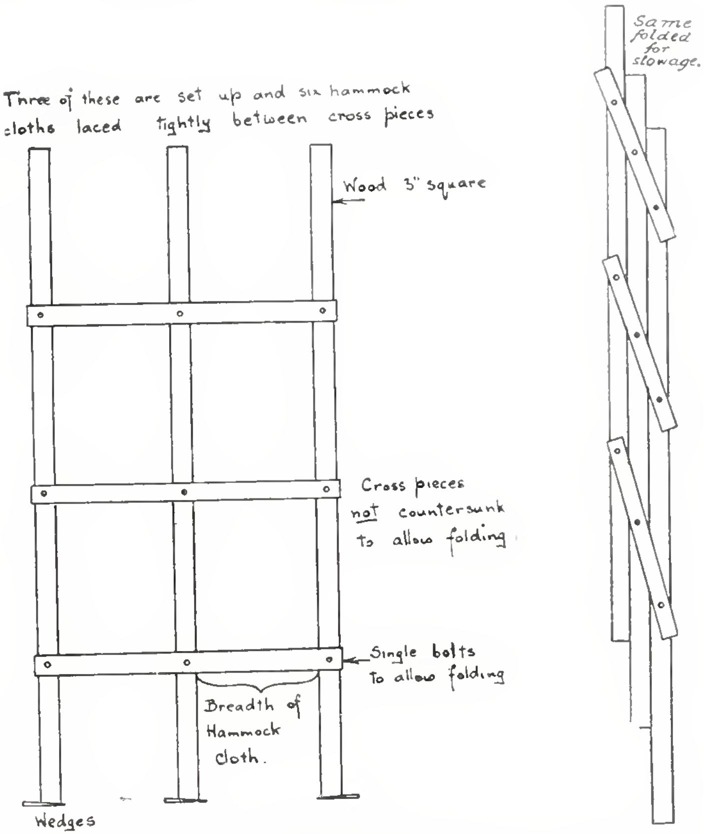

Three of these are set up and six hammock cloths laced tightly between cross pieces
Wood 3" square
Cross pieces not countersunk to allow folding
Single bolts to allow folding
Breadth of Hammock cloth.
Wedges
Same folded for stowage.

FIG. 6.—Upright as used in *Monarch* since August, 1914. Designed by Fleet Surgeon Lavertine.

Evacuation from Ship.

The evacuation of the wounded from a ship is a most important point, both from the wounded man's point of view and also for the efficiency of the ship. The ideal conditions obtain when a hospital ship can go alongside the ship of war; then the wounded can be carried in their service cots and stretchers across a gangway to their beds. This, however, is rarely possible, and the services of the hospital carrier are called in as a go-between. In this case the wounded man is taken in his cot or stretcher and placed in the tray or cot carrier and hoisted out by means of a derrick into a hospital boat or barge, which transports him to a hospital ship, an ambulance train, or a local hospital, as circumstances command. The chief point to be remembered is that the less a wounded or burnt man is moved the better his chances of recovery.

Since the outbreak of hostilities the hospital ships have borne the brunt of the medical work in the fleet. The extreme undesirability of making preparation for action with several bed cases, whether medical or surgical, on board the fighting ship is evident. Cases of sickness or injury, if likely to be under treatment more than a few days, are therefore transported to the local naval hospital or hospital ship.

HOSPITAL SHIPS.

BY

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F.R.C.S.Edin., R.N.,
Late Senior Medical Officer, H.M. Hospital Ships *Maine*, *Rohilla*, and *Garth Castle*.

Before the war there was only one British hospital ship in commission, the *Maine*, which was originally fitted out by a group of American ladies during the South African war and subsequently taken over by the Admiralty. Unfortunately this vessel went ashore in a thick fog on June 19th, 1914, and was lost, but the arrangements for the provision of sufficient hospital ships for the fleet previously made by the Admiralty worked admirably. Within four days of the order to mobilize for war three ocean liners were converted into hospital "carriers," and with their medical and nursing staff, and full equipment of cots, bedding, and medical and surgical stores complete, which had been kept ready in a lay-apart store at one of the large medical dépôts, were at sea, where any necessary alterations were completed by the artisan ratings, so that they joined up with the fleet ready for any emergency.

In the meantime work was being pressed forward in six other ships intended for more permanent service from plans which had already been prepared during peace, so that they were ready for sea in about three weeks or less. These vessels wore mostly intermediate liners, in which the passenger accommodation and cargo space were easily adapted to their new purpose. The swinging cots fitted averaged about 220, but additional emergency accommodation was provided for about 300 more patients. In the Mediterranean this number was sometimes largely exceeded, over 900 cases being conveyed to a base hospital on one occasion.

As a rule there are six or seven wards for men (Fig. 7) and two or three for officers, which were adapted by converting portions of the saloons or removing cabin bulkheads, some officers being also nursed in cabins. A padded room for mental cases was also prepared. The decks are covered with green corticine, which is easily kept in a high state of polish; the bulkheads and cots are enamelled a very light green. Ventilation is maintained by means of scuttles, supply and exhaust cowls, and special motor-driven supply ventilators. The wards occasionally became rather hot at night when dead-lights had to be closed; but this was corrected by Fleet Surgeon M. H. Knapp's plan of fitting the cylindrical portions of ordinary wind scoops with partial diaphragms which occupy about two-thirds of the circumference, so that while air is freely admitted no light shows through. Other alterations included the fitting up according to the existing plans of dispensaries, pantries, latrines, mortuary, disinfector for clothes and bedding, cot lifts both inside and outside the ship, *x*-ray room, laboratory, laundry, operating rooms, and many other necessary adjuncts of a self-contained hospital. These necessary fittings had also all been stored in readiness before mobilization.

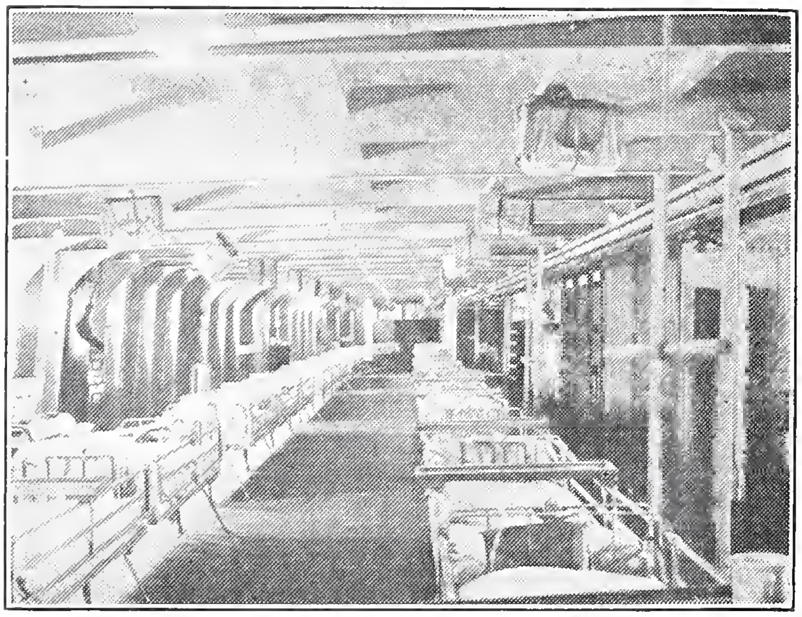

Fig. 7.—Ward.

The operating theatres are installed either in music rooms or saloons, or in specially constructed erections on the upper deck (Fig. 8). In the former case the somewhat ornate walls are covered in with match-boarding enamelled white. The rooms are divided into two parts with separate entrances and sliding doors between—one half being used as a preparation and sterilizing room. The decks are tiled and all the tables, shelves, and other structural arrangements are of the aseptic pattern. In spite of their extemporized character, it does not appear that any case of sepsis could be definitely attributed to faulty surroundings.

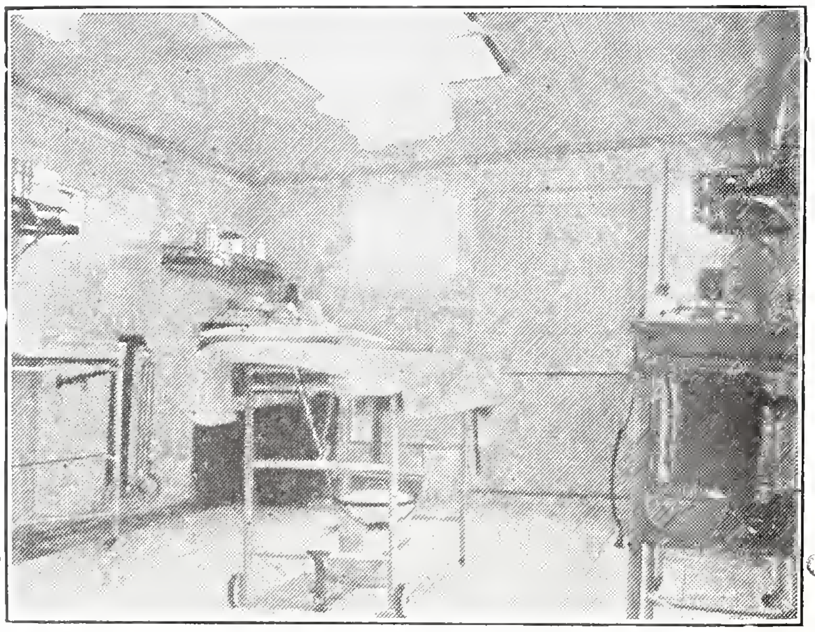

Fig. 8.—Operating room.

The cot-lifts which serve the wards are placed near the operating rooms so that the exposure of a patient after anaesthesia is reduced to a minimum. The original supply of instruments and medical and surgical stores met the initial requirements; but subsequently, as it became necessary, further equipment was provided by the Admiralty.

General Duties.

On the Home Station the work of the hospital ships is to a large extent similar to that carried out by the *Maine* in peace time. The Fleets at their different bases—often in remote districts where no shore accommodation is available—are attended by one or more ships. When nearly full they are either cleared by smaller hospital ships which convey the patients to a convenient rail-head for further transference by ambulance train, or at stated intervals the hospital ships are relieved by others, steam to a railhead to discharge their cases, and are then coaled, provisioned, and if necessary repaired or refitted.

It soon became evident that any preconceived ideas of hospital ships proceeding to the scene of an action had to be discarded. Apart from the difficulties of transporting wounded men from the fighting ships in bad weather at sea it was obvious that the conditions of modern naval warfare precluded these ships from remaining with their engines stopped without running grave risk of being torpedoed by submarines.

Embarkation.

In harbour the conveyance of patients is carried out by converted drifters or in ships' picket boats and cutters. Some of the former are fitted to take eighteen cot cases under cover, and in bad weather are far preferable to ships' boats. On arrival alongside, the cots are hoisted in, by hydraulic or steam cranes, in a tray which would take either a service cot or a stretcher (Figs. 9, 10, 11). The original trays were gradually improved upon, and were fitted with a removable end or side, whereby the process of transfer is much facilitated. When comparatively large numbers of men wounded in action have been brought in by destroyers and light cruisers, it has been found quite possible to get these vessels alongside the hospital ship, which considerably accelerates the transfer.

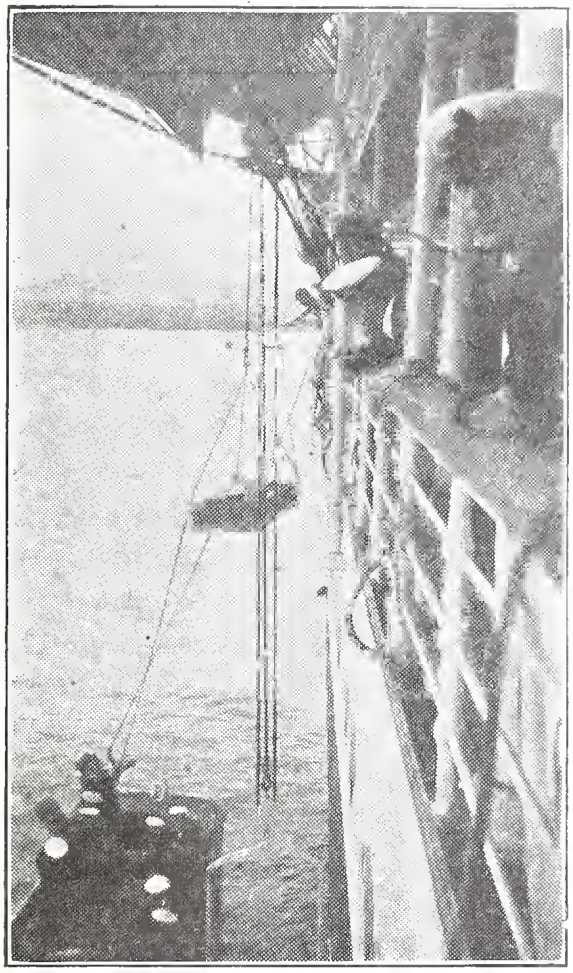

FIG. 9.—Cot case coming on board from a ship's boat.

Opinions differ as to what class of cases should be dealt with by hospital ships after an action and what transferred further by ambulance train. There is much to be said for the view that the very severely wounded and those suffering from much shock are more satisfactorily dealt with in the former. The transference from a fighting to a hospital ship is accomplished with the minimum of disturbance; and, as now equipped, these ships are capable of dealing with anything. After the Jutland battle there was a considerable number of patients with severe burns who certainly could not have borne a long train journey; their care entailed heavy work on the staffs of the ships which received them. It must be borne in mind, however, that when cases on board hospital ships that can travel by train are retained, there are no means of dealing with a fresh lot of wounded that may come in at any time. The hospital ship is, in fact, demobilized *pro tem.*, a most undesirable proceeding.

Staff.

The medical staff consists of one fleet surgeon in charge, six other medical officers, and a dental surgeon. A chaplain also is borne. The surgeons in the first instances, in addition to active service medical officers, were drawn from the

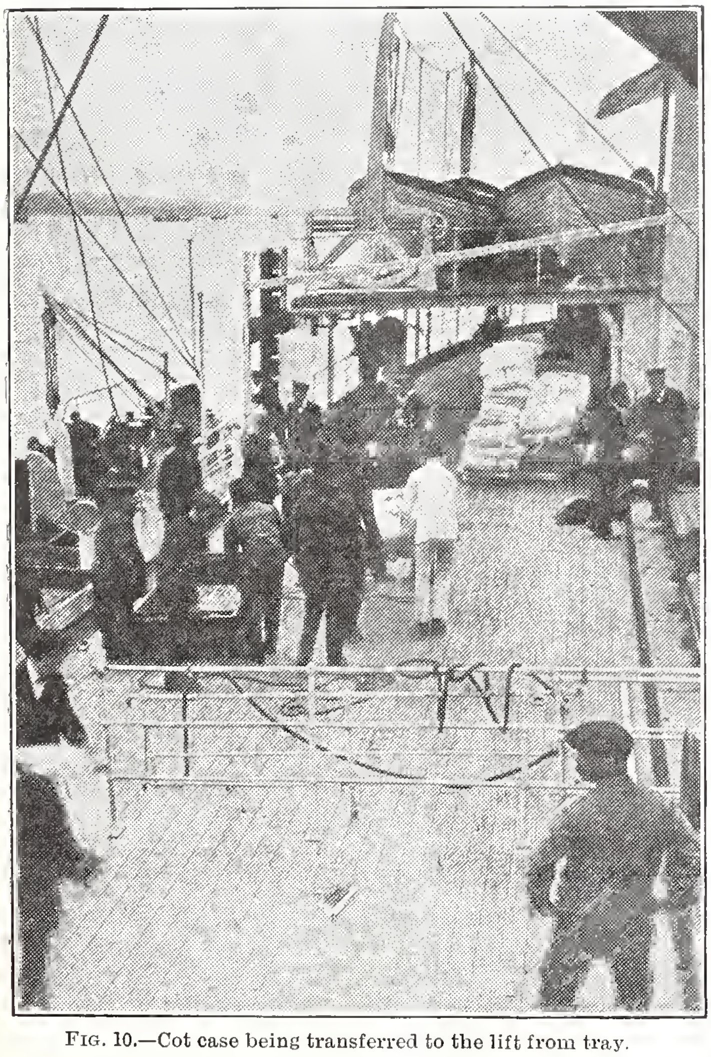

FIG. 10.—Cot case being transferred to the lift from tray.

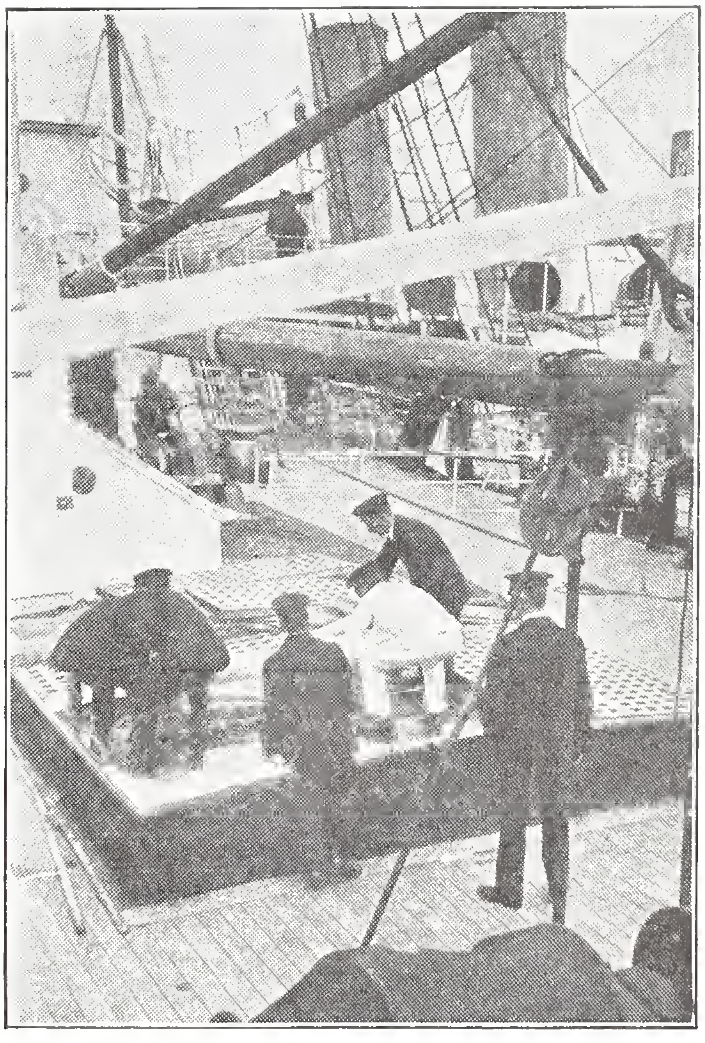

FIG. 11.—Cot case being lowered into the wards by the lift.

Royal Naval Volunteer Reserve, amongst whom were many holding honorary hospital appointments in civil life. Extremely valuable services were rendered by these officers, among whom were bacteriologists, ophthalmic surgeons, and *x*-ray experts. As time went on, special departments were gradually developed, with the result that a degree of efficiency has been obtained remarkable for a floating hospital.

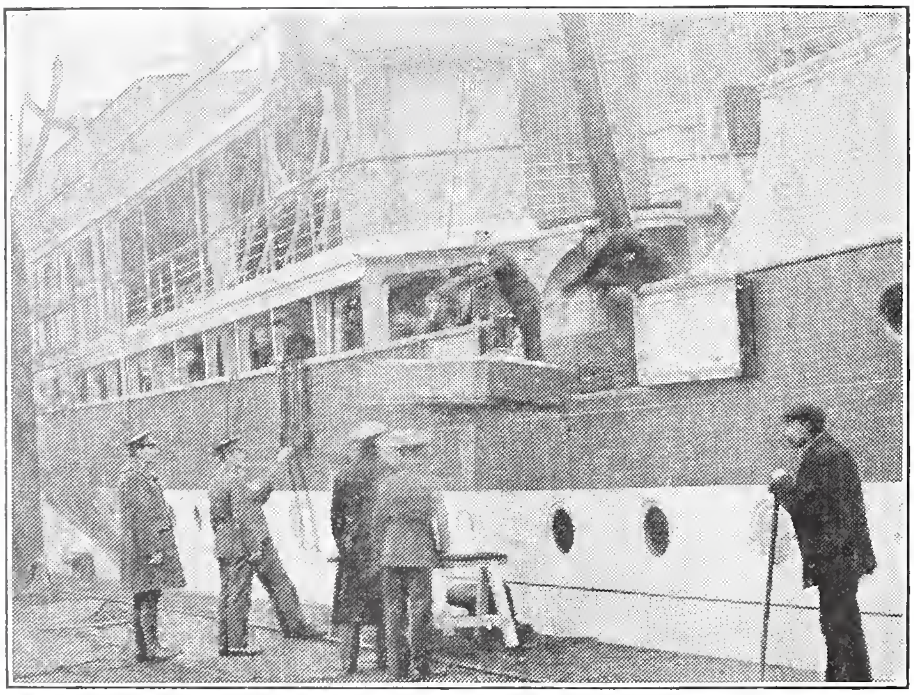

Fig. 12.—Disembarking.

The nursing staff consists of four Royal Naval or Reserve Nursing Sisters, and some thirty-five men, of whom about one-third belong to the regular Naval Sick Berth Staff and the remainder to the Reserve. The latter, drawn mainly from mining and manufacturing districts, were well trained in ambulance work, but as their nursing capabilities were naturally of a less high order, much responsibility fell upon the Sisters, who have admirably justified their calling. The remainder of the complement includes carpenter ratings, master-at-arms, and ship's corporals for baggage and police duties, writer, and signalman.

Improvements are constantly made in these ships; for instance, in the *x*-ray room of the *Garth Castle* aërial leads were installed, viewing boxes and adjustable carriers for water-cooled tubes made, and many other accessories fitted up by the ship's artisans and electrician under the supervision of the surgeon in charge of the department.

In the laboratory the ordinary clinical and pathological examinations are carried out, and facilities provided for culture work and the thorough investigation of cerebro-spinal fever contacts and carriers. For examination of acuity of vision, especially that of gun layers, all the hospital ships are provided with trial glasses and a dark room, where an ophthalmic surgeon or other member of the staff with a good working knowledge of sight testing and retinoscopy is always available. Among the temporary surgeons there are several gynaecologists, and their surgical experience is turned to good account on more general lines. On one occasion a successful Caesarean section was performed in a remote district where no other professional aid was obtainable. The operative work is often heavy, the cases being those ordinarily met with in a naval hospital. Appendicitis is fairly common, and on one occasion seven gangrenous cases were operated upon in one day.

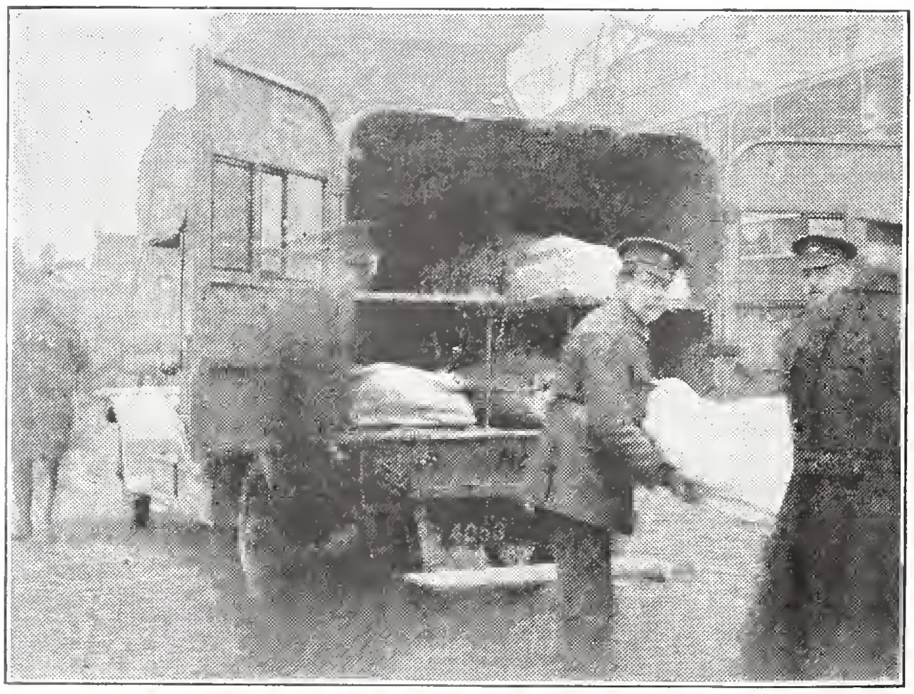

Fig. 13.—Disembarking: Removal to Motor Ambulance.

In the *Garth Castle* iodine was mainly and successfully used for the cleansing of wounds, skin preparation, catgut, etc. Hypertonic saline solution was also much in vogue, both for arm and leg baths and as a dressing. The formula used was a solution containing 0.85 per cent. sodium chloride with 0.25 per cent. of sodium citrate. The results obtained were excellent; septic wounds and burns became clean and healthy in a wonderfully short space of time. Fleet Surgeon A. R. Bankart's apparatus for obtaining a solution containing free chlorine by the electrolysis of sea water proved quite efficacious.

The dental surgeons are always busy, and are of immense service to the personnel of the Fleet. At one time there were three of these officers living in the hospital ship at a certain base, the foremost operating and preparation rooms being given up to them. The equipment supplied is very complete.

Two features were introduced which proved of the greatest benefit to the Fleet. The first was the systematized use of galyl in all hospital ships. At first patients requiring this treatment were sent to the South of England, occupying valuable beds in hospital carriers and trains, and their services were lost for a considerable period. Later on such patients were sent to the hospital ships for two or three days, the injection was given, the particulars entered in their special history sheets, and they then returned to duty until due for their next dose. Whatever hospital ship was present then carried on the treatment, with resulting economy of time, money, and service. Systematic examinations of the urine for arsenic were also carried out.

The other feature was the provision of a ship specially for zymotic diseases. The ordinary hospital ships are not able to deal with these cases without seriously impairing their general efficiency, so the advent of the *Agadir* was the greatest possible boon. The drafts constantly coming from the various dépôts often bring sporadic cases of infection, and their early isolation is a matter of importance. The laundry and disinfecting plant are two other items in constant request. Clean bed linen and patients' clothing went far towards giving the ships their reputation for always looking fresh and sweet. The contrast to a sick man coming from a fighting ship always prepared for action and often coaling is very great. The large high pressure disinfector is in great demand, much bedding and clothing being brought from auxiliaries and small craft which have no facilities for this work.

Disembarkation.

This is simply the converse of the process of embarking a considerable number of cases. As has already been stated, it is done in two ways—that is, either by discharging to a smaller hospital ship which came alongside or by the ship herself proceeding to a port with rail facilities. In the latter case, the number and class of cases having previously been telegraphed, a fleet of motor ambulances and baggage lorries is in attendance on the jetty as soon as the ship is tied up. The clerical work, sorting of baggage, labelling for the different base hospitals, etc., has all been completed on the voyage, so that little time is spent over the actual disembarkation. The requisite number of cots are placed in readiness in each ward, and the patients who are unable to walk placed in them. Baggage and walking cases are got out first, the latter proceeding down a brow or the ship's gangway ladder. The cot cases are then brought up in rapid succession in the lifts, transferred to the tray, and hoisted out. Padded trestles are placed on the jetty to receive the tray, and the cots are transferred to the waiting ambulances (Figs. 12, 13). The canvas cots are uniform and interchangeable with those of the ambulance train, so that there is no further disturbance of the patient, the same number of empty cots being received from the train.

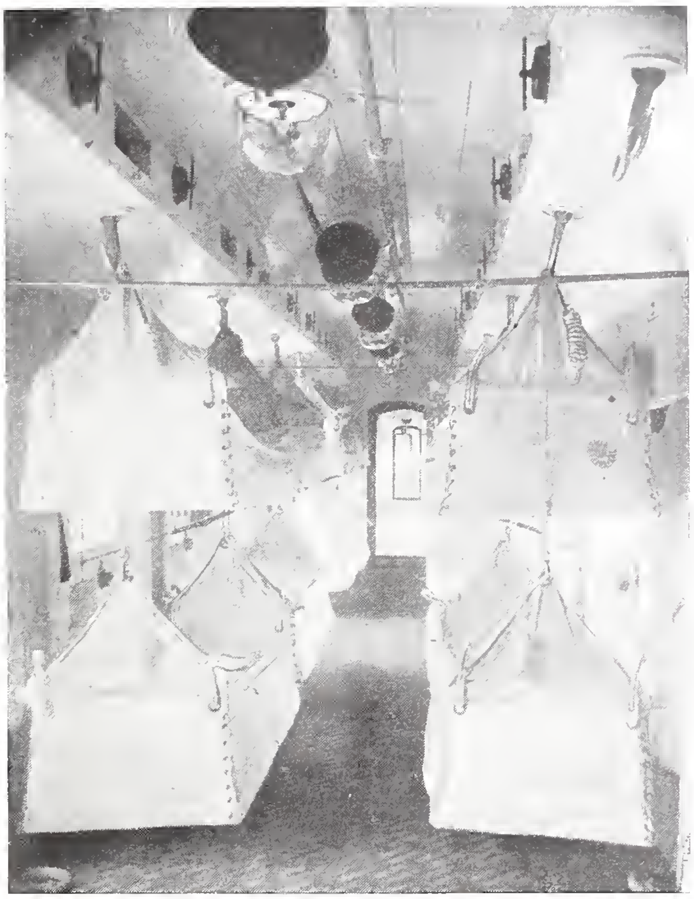

FIG. 14.—Showing cots slung in ambulance train.

The Naval Medical Transport Department now takes charge of the cases, so that when the last patient and kit-bag are over the side the professional work of the ship ceases for a short space, and a proportion of the staff are enabled to get well-earned leave as the last weeks of the round trip are always strenuous.

ACCOUNT OF LAND MEDICAL TRANSPORT ARRANGEMENTS OF THE NAVY.

BY

Surgeon General SIR JAMES PORTER, K.C.B., K.C.M.G., M.D., R.N.,

AND

Staff Surgeon A. VAVASOUR ELDER, R.N.V.R.

THE removal of sick and wounded from the scenes of their activities to the seclusion of a hospital is no small factor in the general work of the Medical Department of the Navy.

To deal with this phase of medical work a special medical transport organization has been created. There is a central office at the Admiralty for the Principal Medical Transport Officer, and thus in immediate touch with the department. Medical Transport Officers are established at the chief naval ports, and finally Assistant Medical Transport Officers have been appointed at all places round the coast where wounded are likely to be landed after action. At each of these places provision has been made for establishing dressing stations and temporary hospital accommodation for a certain number of cases until such time as an ambulance train can be sent to remove them to base hospitals elsewhere.

One of the difficulties of the problem of dealing with naval cases after action is the impossibility of arranging in advance or foretelling exactly at which spot and in what numbers wounded will be landed. Certain obvious bases, it is true, exist, to which ships able to do so would naturally return after an action. But at the same time these bases are wide apart, leaving large gaps of coast line with many ports, into any one of which rescue vessels and smaller damaged vessels might be compelled to enter and discharge their wounded. Hence the establishment of what are termed emergency medical dépôts, with Medical Transport Officers in charge of each at various places along the coasts. Thus no likely place is left without means of coping with a sudden inrush of wounded and rendering medical aid to them.

Briefly, from the time a wounded man is landed from a ship until he is finally placed in hospital, he is in the charge of the Land Medical Transport branch of the Naval Medical Service. The system adopted by the Navy differs from others in so far that when a man is wounded severely enough to require immediate treatment in bed, after having received medical attention, he is, so to speak, put to bed in

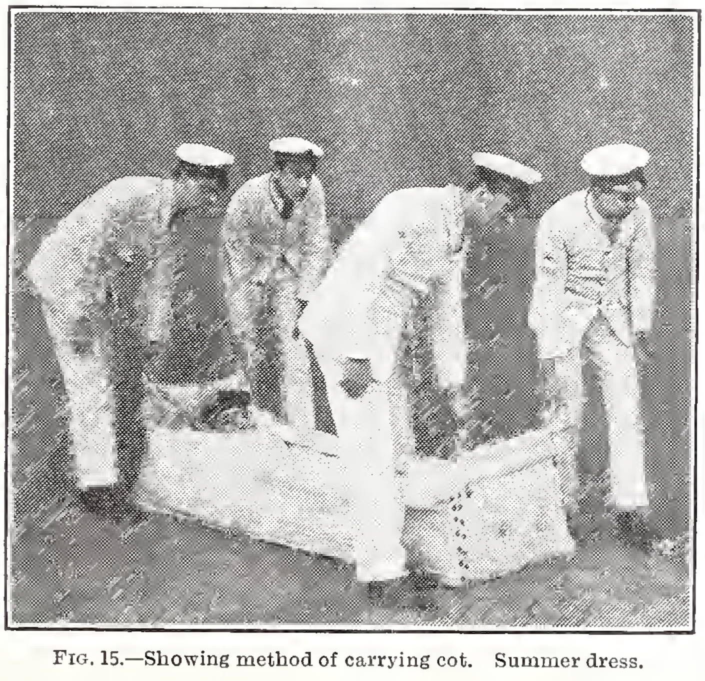

FIG. 15.—Showing method of carrying cot. Summer dress.

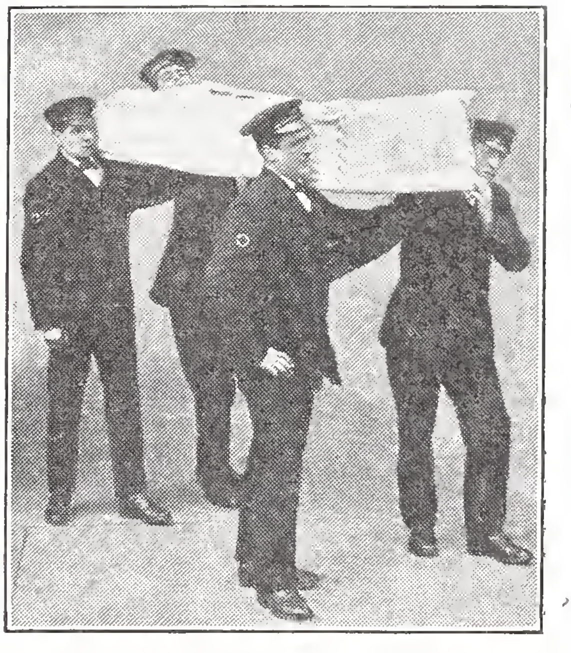

FIG. 16.—Showing method of carrying cot. Winter dress.

his ship in a standard naval cot and made as comfortable as possible in the circumstances. The naval standard pattern cot is composed of canvas stretched over a wooden frame and laced together. At each end of the cot the canvas is extended into a triangle, the apex of which is fitted with a lanyard and an "eye" for slinging purposes, while the canvas at the sides is wide enough to overlap, and so affords extra warmth and protection to the occupant. Each cot is fitted with a mattress, pillow, pillowcase, and two blankets. Thus it is in itself a complete bed wherever situated. From the time a patient is placed in a cot on board a fighting ship until he is finally put to bed in a hospital he is never moved out of it. He and his cot travel together all the way, thus saving much of the pain and suffering involved in the frequent transfers by stretchers, ambulances and trains.

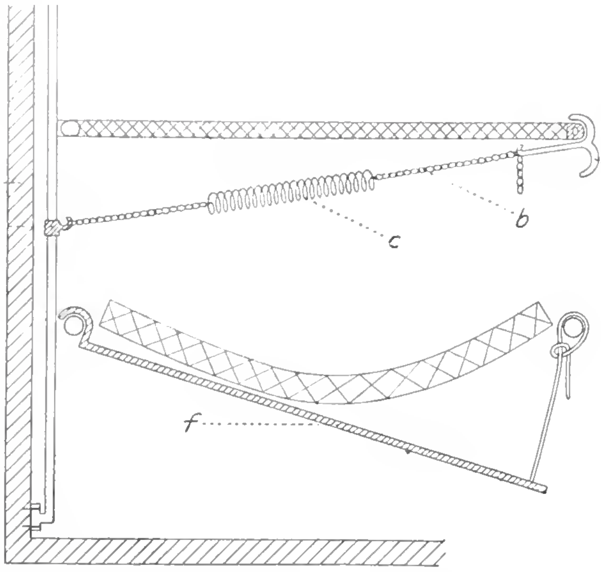

FIG. 17.—"Gripe" and method of diminishing vibration for fracture cases. *a*, Anchor hook; *b*, chain; *c*, spiral spring; *d*, traveller; *e*, side of coach; *f*, fracture slat.

To carry this out all the ambulance trains, motor ambulances, bearer parties, and so forth, have been specially organized in a standard and uniform manner with regard to each individual link of the transport chain. This may be best described by tracing the journey of a patient from the commencement. The patient and his cot complete with bed and bedding are landed from the ship and turned over to bearers specially trained in the handling of cots. These bearers are drawn from ratings of the Royal Naval Auxiliary Sick Berth Reserve attached to the Medical Transport branch in the case of large naval centres, and in other places they are drawn from Voluntary Aid Detachments of the Order of St. John of Jerusalem in England and the British Red Cross Society. The bearers carry the cot to the ambulance or ambulance train as the case may be, and there it is placed in position. In exchange for the "loaded cot" the ambulance or the ambulance train gives a clean, empty, and fully-equipped standard cot for return to the ship from which the patient was received. In this manner the fighting ship always maintains her complement of clean cots.

When an ambulance or train is filled it moves off to its destination, and on arrival the same exchange of cots is made as before, and so on throughout each link until the patient is finally taken out of his original cot and put in bed in hospital. By this method there is a constant outgoing stream of clean cots from the base to the ships at sea all ready for further service. Everything connected with the land transport of wounded is maintained in a state of immediate readiness, and finally, and most important of all, the wounded themselves are spared the sufferings caused by repeated transfers from ambulance stretcher to ambulance train and back again to another ambulance stretcher, etc. Also the time taken thus to empty an ambulance train is very brief, and the delay to ordinary passenger traffic practically *nil*. At the large naval bases arrangements exist for the cleaning of all cots and bedding, and a store of clean cots for exchange purposes is also established.

In the ambulance trains the cots are suspended in two tiers from the roofs of the coaches. They are prevented from swinging by a spring clip, devised by Staff Surgeon Elder, which presses the cot against two padded buffers built in to the side of the coach. By this method the cot and patient do not form a component part of the coach. The jolting of the train over the metals is largely taken up by the suspension, while lateral jars when rounding curves and the like are absorbed by the padded buffers. Thus the cot has just enough "play" for comfort and *no more*, while the train is under way. The tension of the spring clip is adjustable at will, and, unlike the "fixed bunk," every jarring movement of the coach is so minimized as practically not to disturb or distress the patient. The coaches themselves when empty of cots have no fittings except a few chains and hooks, and are easily cleaned and disinfected.

As regards the ambulances in general, beyond being fitted specially to take naval cots instead of the military stretcher, they present nothing else of interest except a squadron of thirty motor buses. These buses were taken over from the London General Omnibus Company at the commencement of hostilities and were fitted with spring trestles on which the cots rest. They have proved satisfactory in every way and are just as comfortable for patients as the latest pattern specially built ambulances.

The emergency medical dépôts previously referred to and located at various places along the coast are supplied with "cot," "clothing," "hospital," and "medical units" respectively. The cot unit consists of completely equipped service cots, which can be used to form the nucleus of a temporary hospital in suitable local buildings selected in advance for this purpose. The hospital and medical units containing all the necessary utensils, drugs, and dressings, etc., are kept available for immediate use in these extemporized hospitals. The clothing unit, as its name implies, is for use of men suffering from immersion and lack of clothing, so as to enable them to proceed in dry clothes to wherever they may be sent.

In addition to preparedness for "The Day," the Medical Transport Department is continuously engaged in the removal of ordinary sick from the fleet at the various ports. The unloading of hospital ships from the fleet and overseas is also part of its duties. The sick are taken each to his home port, in close touch with friends and relatives. During the journey the patients are fed, each according to his prescribed dietary scale. In fact, everything is done for them while in the train. No stops are made except for gas and water or railway requirements when they arise. Owing to the pressure on the railway systems in the north of Scotland the full-sized ambulance trains do not as a rule proceed north of Edinburgh. Cases are brought as far south as Edinburgh from the north by a smaller train, a class of conveyance also found convenient and economical for distributing smaller numbers

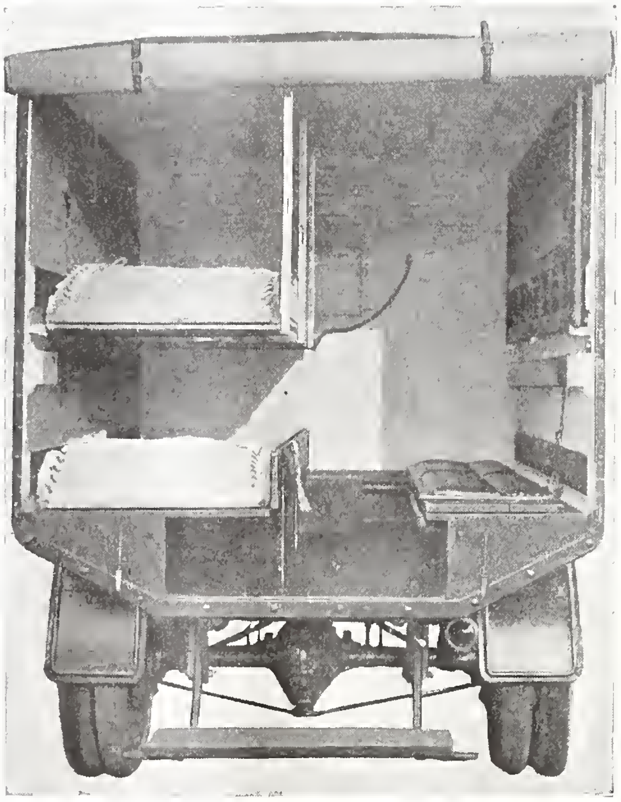

FIG. 18.—Interior of Naval Ambulance.

of cases to auxiliary hospitals, and so aiding in keeping the sea coast hospitals from congestion in emergency.

A full-sized naval ambulance train carries 136 cots and a smaller sized train 40 cots and 36 sitting cases. On routine journeys only the number of patients which a train has cot accommodation for are carried as a rule, so that every patient has a cot to sleep in at night. During daylight hours sitting accommodation is provided for non-cot cases by stacking two cots on the floor all along one side of the coach, a third cot being placed sideways on the uppermost one, and resting against the side wall of the coach. This forms a back-rest, and by this means very comfortable sitting accommodation is obtained which allows the men to sit back and stretch their legs, without interfering with or being disturbed by the ordinary traffic through the coach. Washable canvas covers are supplied for use when cots are thus stacked to keep them from being soiled. At night the cots are slung in position and the coach transformed into a dormitory.

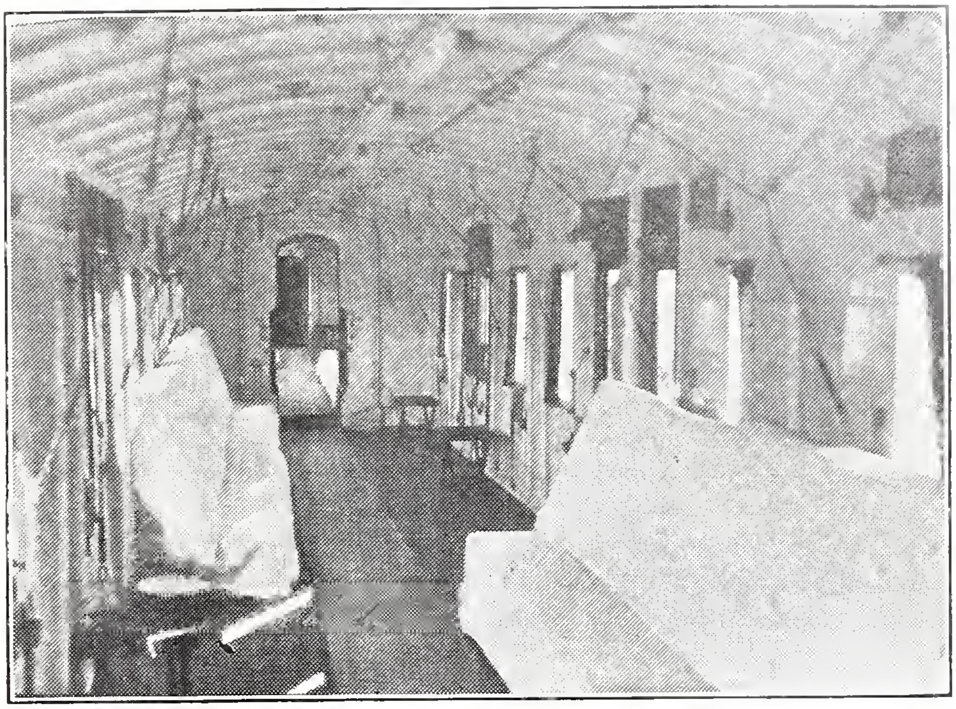

FIG. 19.—Sitting accommodation, ambulance train.

All the trains are self contained and, when in motion, self-supporting, carrying everything in the way of provisions, stores, and so forth, likely to be required on the journey.

The staff consists of two medical officers and thirty-six men, including cooks, clerks—all Auxiliary Sick Berth Reserve ratings — who live in the train continuously. In fact, the trains are practically commissioned like ships and worked as such in the way of duty, regular sea watches being kept day and night. For ordinary routine journeys nursing sisters are not carried, but a cabin is set apart for two in each train for use when required, as after a naval engagement or when any cases calling for their presence are being transported. The nursing itself is done, as in the navy afloat, by trained male Sick Berth ratings.

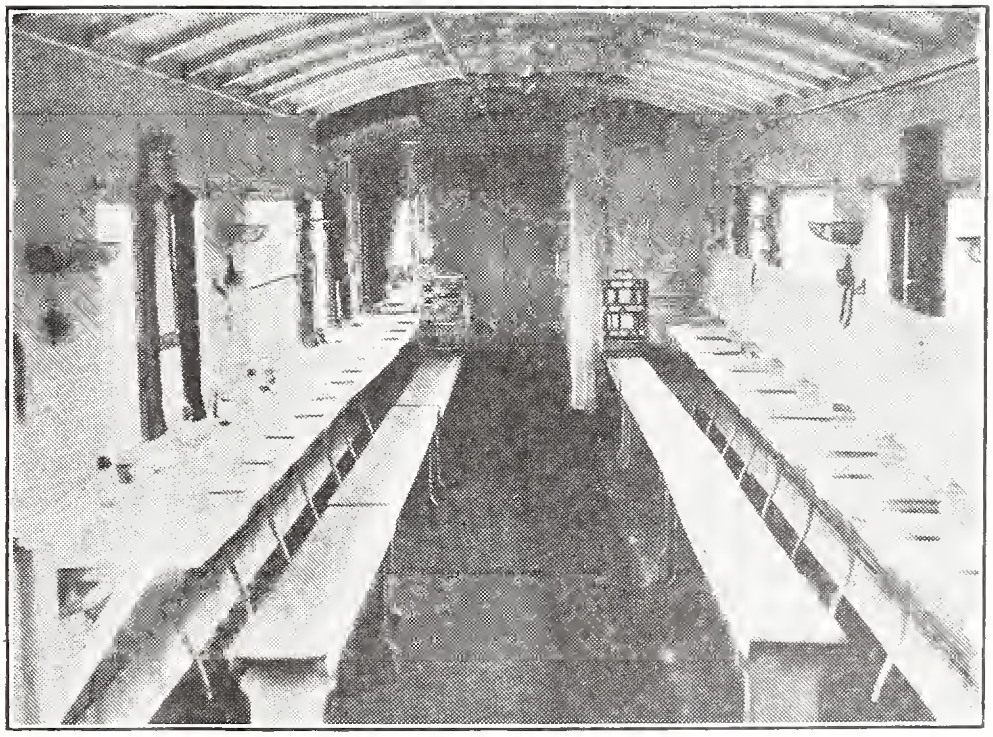

FIG. 20.—Day Coach, ambulance train.

An interesting feature of the large naval ambulance trains is what is known as the "Day Coach." It is fitted along the sides with sections of flap tables, lifting upwards, at which non-cot cases can sit and have their meals or do anything else. Under these tables is a row of wash-basins connected with water supply. These are for use after a night journey or as required, and become available by lifting up the flap table. At one end of each of these coaches two padded rooms are fitted for the more violent mental cases.

A small dressing station supplied with instruments and drugs is also provided. It may, however, be stated here that, practically speaking, there is very little to be done in the way of "dressings" except while the train is at rest. For this reason also no "operating theatre" has been arranged, on the assumption that a case likely to require operation would not be travelling, and also, if such a case were encountered, operative measures would probably have to be applied at the cot side—time would not permit of the case being taken to the "theatre"; or, alternatively, the patient would be landed at the first opportunity.

A portable electric signalling device is fitted at each end of the train and coupled up with the engine, so that communication can be made with the driver by means of a code of signals with reference to speed, heating, etc. The principal parts of the train are connected by intercommunicating telephone. The trains are lighted by electricity—dynamo while running and accumulator when at rest. Electric fans are fitted where requisite, and portable lights are arranged for in all the ward coaches. Gas is used for cooking only, and is carried under the kitchen cars and one car adjoining each kitchen, the cylinders being coupled up together; thus the danger of fire is reduced to a minimum. Heating of the coaches is by steam from the engine, carried in overhead pipes suspended from the roof. While running the internal air current circulates the heat very evenly, and at the same time the floor space is clear of any obstacle which might get in the way of a bearer party while handling a cot. Sanitary arrangements are ample—about 10 per cent. of the carrying capacity of each train, and consist of water-sealed pans. Arrangements are made for "trapping" these while trains come to a halt for any length of time. Large storage capacity for water, domestic and sanitary, is suppled to each train. For administrative purposes a small office is fitted up centrally in the train, and contains typewriter, safe, and the usual office furniture.

CHAPTER VI.

THE DEVELOPMENT OF BRITISH SURGERY AT THE FRONT.

BY

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IT is not possible in a few pages to do full justice to the developments of British surgery during the war, but it is reasonable to place the more salient facts on record, and to summarize, however briefly, the present position of surgical work in the British Expeditionary Force in France and Belgium.

THE REGIMENTAL MEDICAL OFFICER.

It is unnecessary to write at length on the work of the regimental medical officer, for his duties in this war are much the same as they have ever been. He shares the dangers common to the combatant officers and men, and stays with his battalion or brigade, as the case may be. His treatment can only be that of first aid, but he and his orderlies have saved innumerable lives, both by the rescue of wounded comrades from dangerous situations and by careful rapid transport to the field ambulance sections in the support line.

THE FIELD AMBULANCE.

At this, the "advanced dressing station," there is a personnel of two or three medical officers, non-commissioned officers, and orderlies, and it is here that the first-aid dressings can be supplemented by additional dressings and by suitable splints, so as to ensure a more easy transit to the "tent section" of the field ambulance, a mile or two further back.

The field ambulance has not needed to undergo any very radical changes during the war, but its surgical equipment has been very greatly improved and increased, so that it is in all respects well supplied for the performance of any urgent operation undertaken for conditions which do not require that the patients should be retained for any length of time.

The following instructions, which are amongst those issued in all the "armies" at the front, will best indicate the limitations of their work:

> (1) Only operations of emergency should be performed in field ambulances, but the following exceptions must be noted:
>
> > (*a*) Completely smashed limbs should be removed, and the patients retained for at least a day before being sent to a casualty clearing station.
> >
> > (*b*) Haemorrhage should be arrested by ligature of bleeding points whenever possible. If this is not possible, then plugging or direct pressure on the wound itself should be resorted to. Patients should never be sent down with tourniquets on their limbs.
>
> (2) Abdominal wounds and all severe cases requiring early treatment at a casualty clearing station should be sent there by a special motor ambulance direct from the advanced dressing station. They should not be kept waiting for the regular convoys.

A further development of the tent section resulted from the conditions at the battle of the Somme, where, on account of the small area and the few good roads, "corps dressing stations" were created by joining up some members of the staffs of various field ambulances, so as to supply tent accommodation for a thousand or more wounded, with a staff of about thirty medical officers. A unit such as this performed the duties ordinarily performed by several separate field ambulances, and proved very successful as well as economical in medical officers and orderlies.

Motor Ambulances.

It is unnecessary to write much on a subject which is already thoroughly well known to all, but it is the supply of motor ambulances alone that has enabled us to deal adequately with the surgery at the front. One aspect of this subject, however, is very commonly overlooked, namely, the use of motor transport in saving the wounded from capture, for there can be no doubt that, had motor ambulances been supplied in large numbers, the tale of British prisoners after Mons and Le Cateau would have been very small. The first complete convoy came to the front in the middle of October, and at the first battle of Ypres was of the utmost possible value, both in getting patients quickly to the casualty clearing stations and also in saving wounded from falling into the hands of the enemy during our retirement to the ground we subsequently held.

Without the motor ambulance the whole system would break down, for no horsed vehicles could possibly deal with the numbers of a heavy fight unless they were so numerous that they would practically block the roads for all other transport, and even then their slowness would result in such delays in delivery that surgery would be of little use. In addition, the well hung and well driven motor causes the patient infinitely less distress than the old ambulance wagon, and so delivers him in a much better condition for recovery.

THE QUESTION OF TIME.

This is a matter of so much importance to surgery that it is well to explain the time that is required to take a patient from the front trenches to the casualty clearing station. It is, in the first place, not sufficiently realized that the chief cause of delay, if it occurs, is "the enemy," for there have often been, and there still are, localities from which the wounded can only be moved under cover of darkness, so that a man may have to be kept in a dug-out the whole of a long summer's day before he can be carried to the rear. Again, in the desert of mud behind the firing line on the Somme stretcher-bearers sometimes took hours to carry a wounded man at night for several miles to the nearest point to which, in the absence of all roads, an ambulance wagon could approach. In yet other cases men lie out in the open ground on the so-called "No Man's Land" for many hours, or even for several days, before they are rescued. But supposing that none of these difficulties exist, the time occupied is very short, for, if communication trenches are good, and if a man is able to walk, he will often get to the advanced sections of the nearest field ambulance within an hour. If the communication trench is long and muddy, it may take twice that time. If he has to be carried it may take another half-hour or more, but as soon as he has got to a good road another hour will see him safely delivered to the place where his injuries can be thoroughly treated and where he can be well nursed under excellent conditions.

All this is comparatively simple if no great battle is in progress; and as great battles occur at infrequent intervals, it is evident that in most parts of the line of trenches evacuation is easy and rapid except for unusual local conditions. But in very heavy fighting, and especially when troops are advancing, it is often impossible to find sufficient stretcher-bearers in proportion to the great numbers of wounded, for only a limited number are attached to each regiment, and it is therefore necessarily true that the greater the number of the wounded who have to be carried, the longer must it be before the last of them can be brought in. No work is heavier than stretcher carrying for long distances and on difficult ground; and as men become exhausted their pace becomes slower, and they are obliged to rest at more frequent intervals. But even when all difficulties have been surmounted and the patients have arrived at the tent sections of a field ambulance, there are many who are too much exhausted for further immediate moving; and while the staff may have their hands full with dressing the wounded, they have also to care for the needs of the many men who need to be rested, fed, and warmed. While they are thus engaged on these patients, all those who require urgent treatment by operation have been taken direct to the casualty clearing stations, and thus have avoided delay.

The speed with which even patients who have to be carried can be brought in is best shown by taking the case of a consecutive series of abdominal wounds at one of the more advanced units. The following are the figures, and they show both how quickly men can be brought in when there are no unusual difficulties, and also how long it may be before a man can be rescued when an attack has been temporarily driven back.

Time of Evacuation to Casualty Clearing Station.

Under 3 hours	24	78 in first 6 hours.	134 in first 12 hours.	169 in first 24 hours.	200
Between 3 and 4 hours	20				
,, 4 and 5 ,,	24				
,, 5 and 6 ,,	10				
Between 6 and 9 hours	34	56 in second 6 hours.			
,, 9 and 12 ,,	22				
Between 12 and 18 hours	25		35 in second 12 hours.		
,, 18 and 24 ,,	10				
Over 24 hours				31	

The Casualty Clearing Stations.

The development of the casualty clearing stations has been the most important factor in the creation of a new school of surgery at the front, and it is not too much to say that they have saved many thousands of lives which would have been lost but for the surgical opportunities which they have provided.

Before the war the "C.C.S.'s," as they may be named for brevity, appeared only on paper and as untried units, for they did not exist at the time of the South African war. They were originally called "clearing hospitals," and their proposed function was merely to clear the field ambulances and pass the patients on to the base hospitals. Their equipment, therefore, was only very slight, and their staff of eight officers, including the command officer and the quartermaster, was less than the staff of a field ambulance. They carried 200 stretchers, and were supposed to be able to deal with the same number of patients.

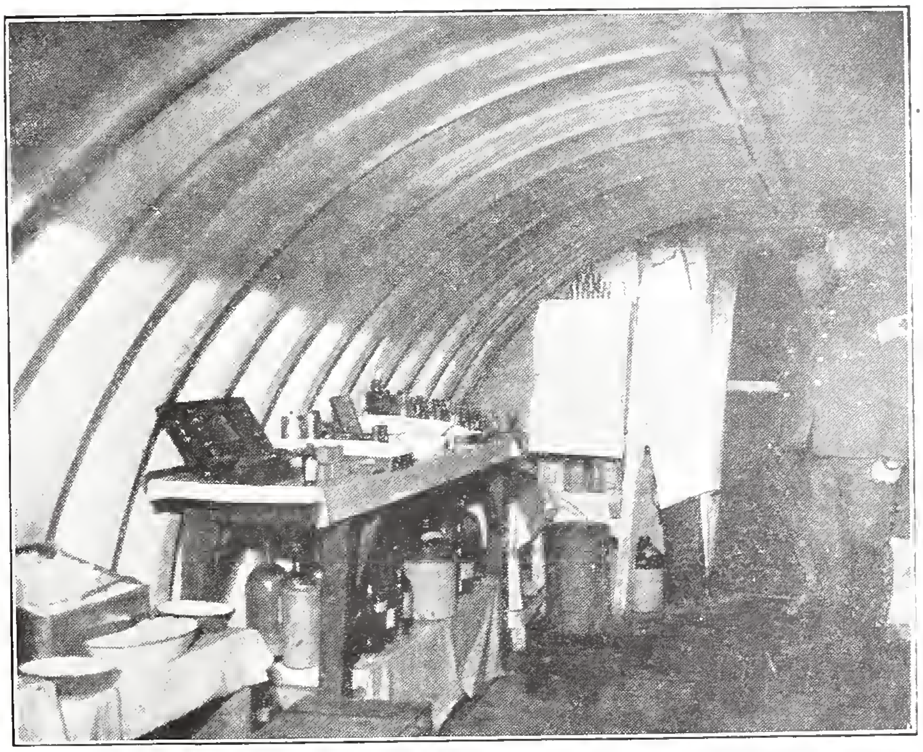


Fig. 1.—Interior of regimental aid post.

It is not necessary to enter into details to show how the six casualty clearing stations, which came with the original Expeditionary Force, were overtaxed, for, in spite of this, it became very evident during the first battle of Ypres that the casualty clearing stations might well be made the nucleus around which to build an efficient organization for much more complete surgical treatment than had been contemplated when they were first planned. The first change was the supply of bedsteads and bedding and the appointment of trained nurses; the next was the addition of more surgical equipment in the way of instruments, splints, sterilizing apparatus, etc. The selection of special surgeons was a natural consequence, and before the end of the year 1914 good surgical work was being done at eight centres. Since that time there has been further development and progress, and by the end of 1916 more than fifty casualty clearing stations were at work.

These hospitals, for such we can call them, are situated behind the line of trenches along the entire front, and certain local conditions are essential for the success of their work. First, they must be at or near to railway sidings, so that evacuation by train is easy. Secondly, they must be where good roads can connect them with the front. Thirdly, they must have a good water supply.

They are arranged in practically two series: (1) Those nearest the front are at a distance of from six to nine miles from the front trenches; (2) those of the second line are from three to six miles further back, and act as a reserve during active operations, or as units for special cases during quieter times.

The casualty clearing stations vary greatly in their accommodation, according to the size of the buildings they may occupy, or to the amount of ground available for huts or tents when they are encamped. The smallest accommodate 400 to 500, and the largest from 800 to 1,200. Their staff is reinforced, as may be required, from other casualty clearing stations less actively employed, and from the staffs of the field ambulances.

Wherever possible the casualty clearing stations at the front are linked in pairs, and take in the wounded alternately. In this way it can be arranged that, after admitting as many as can be adequately treated, the wounded are diverted to the other casualty clearing station, and the staff is left free to treat those they have admitted, without being disturbed by fresh arrivals.

Operating Theatres.

When a casualty clearing station is housed in buildings these theatres must, of course, vary in size with the accommodation afforded. In the hutted or tented hospitals, however, which are the most numerous, the operating theatre is a hut about 60 ft. by 20 ft., giving space for four tables, and for sterilizing and store rooms. Large theatres are essential in dealing with large numbers.

The Treatment of Wounds in the Casualty Clearing Stations.

It is the object of every casualty clearing station to treat and retain all patients until they can be safely sent down by ambulance train. In times of comparative quiet there is no difficulty in attaining this ideal, and consequently, whatever standard of treatment is required from the surgical standpoint can ordinarily be attained. In times of heavy fighting, and especially when there is the certainty that many more wounded will arrive during periods extending over days or weeks, it is evident that the provision of empty beds necessitates sending patients away who might, with advantage, be retained a little longer. This pressure, however, does not prevent the performance of all really necessary operations, and these are now always performed. If the requirements of our army did not place a limit on the number of surgeons, nurses, orderlies and patients who can be retained in close proximity to the fighting line, there would be no reason why all patients should not be kept near the front, but it must be clearly appreciated both that there is this limit in every war, and also that casualty clearing stations are maintained everywhere in as great numbers as the military authorities can permit. It must also be remembered that if many hundreds of patients were kept in every casualty clearing station the staff of nurses and orderlies would be so much occupied in dressing and caring for them that they would not be free to attend to the wants of the recently wounded men coming in convoys from the field ambulances.

For more than two years it has been the deliberate policy of the British Army Medical Service to make the casualty clearing station the chief place for the treatment by operation of the dangerously wounded man who requires prompt treatment, rather than the field ambulances. The latter is too mobile and too frequently moved a unit to be thoroughly well equipped surgically, and, in addition, it has been proved to be much better to move a patient before an operation to a place where he can be kept and nursed for several days rather than to move him directly after he has been operated upon.

Dressing and Distribution of the Wounded at a Casualty Clearing Station.

It is now the custom of all casualty clearing stations to dress their patients in large reception huts or tents as soon as they arrive, and to distribute them from this place in three classes: (1) For immediate evacuation; (2) for retention; (3) for operation. In the first class are included chiefly the slightly wounded. In the second class are patients suffering from shock, from the effects of bleeding, from wounds of the lung, from exposure to cold, etc. In the third class are all serious wounds of the soft tissues which require thorough dressing, and especially lacerated wounds due to shells and bombs; most fractures; many injuries of vessels; all perforating abdominal wounds, etc.

The proportion of cases requiring operations to the whole number of wounded will depend on many conditions—for example, the larger the proportion of shell wounds to bullet wounds the larger is the number requiring operation, and if a train is waiting to go to the base, men may be sent by it who would require operation if they had to be kept for thirty-six hours. But it may be stated in general terms that the proportion of patients treated under anaesthetics may be as high as one in four, but is more often about one in six.

The following table, compiled by Captain Hey, who is the Surgical Specialist at one of the forward casualty clearing stations, will give a very good idea of the operating work of a particular unit, and it includes a period of heavy fighting during a recent battle:

Table of Operations Performed at a Casualty Clearing Station.

A. Ligature of arteries:	
Carotid	5
Vertebral	2
Subclavian	2
Axillary	15
Brachial	39
Radial	18
Ulnar	8
Ext. iliac	2
Femoral	51
Popliteal	31
Ant. tibial	16
Post. tibial	58
Various	30
	277
B. For treatment of fractures:	
Skull	189
Vertebrae	18
Humerus	298
Forearm	133
Femur	299
Leg	309
Jaws	38
Various	119
	1,403
C. For treatment of joints:	
Knee	183
Other joints	64
	247
D. Amputations:	
Shoulder joint	14
Upper arm	77
Forearm	31
Thigh	186
Knee	10
Leg	76
Ankle	6
Various	31
	431
E. For drainage of pleura	49
F. For wounds of the abdomen	106
G. Removal of testis	33
H. For ruptured urethra	9
J. Enucleation of eye	43
K. Plastic operations	33
L. Tracheotomy	17
	280
M. Excision and cleansing of wounds:	
Head and neck	95
Trunk	309
Upper limb	249
Lower limb	765
Multiple	398
	1816
N. For conditions not due to gunshot wounds:	
Appendicitis	34
Strangulated hernia	1
Cellulitis	53
Various	13
	101

It will be seen that the total number of operations performed for gunshot wounds amounts to 4,554, and the total number of wounded admitted during the period in question was 20,589 in this particular unit. It will be noticed that a very large majority of the operations were for fractures of the limbs and wounds of the soft tissues which required complete surgical clearing. The proportion of abdominal operations would have been higher but for the fact that an "advanced operating centre" was near at hand, and took charge of many cases of this class.

During heavy fighting, operating work such as the above goes on continuously day and night, and consequently necessitates relays of surgeons, nurses, and orderlies. The work is exceedingly trying, and it must be reckoned on that not a few of the staff will be more or less knocked up after three or four weeks of it. But it is also quite certain that the early and thorough treatment of a very large proportion of all wounds has done more than anything else to save both much suffering and many lives.

ADVANCED OPERATING CENTRES.

It has sometimes been found that difficulties of locality have prevented the placing of so large a unit as a casualty clearing station exactly where its position should have been when heavy fighting has been expected, and in such cases a smaller unit has been placed so as to deal with the most urgent cases, and especially with those which required prompt operation. These small special hospitals of fifty to sixty beds have done excellent work, and a very large proportion of their cases have been abdominal wounds. The large number of the casualty clearing stations has prevented any necessity for creating many such units, for the casualty clearing stations are usually as well placed as is the special hospital, and the greater number of all the abdominal operations have been performed in them.

SPECIAL HOSPITALS.

Special Hospitals for Head Cases.

Operations for wounds of the head are dealt with in a subsequent section, and all that need be said here is that it has been found advisable to retain a considerable number of these cases near the front either in stationary or general hospitals, or else in a casualty clearing station of the reserve. They do not need the immediate operations required for abdominal cases, and are consequently provided for further back.

Special Hospitals for Shell Shock.

It is very desirable to remove such cases from the sound of shelling, and, as they require special treatment for some time, they also are dealt with in the rear of the front line of casualty clearing stations.

Special Hospitals for Diseases of the Skin.

These deal mainly, but not exclusively, with scabies, and the work is usually undertaken by the casualty clearing stations of the second line.

Stationary Hospitals at the Front.

A few of these units, which normally belong to the line of communication, also find a place at the front. So much of the work which would previously have been done in them is now performed by the casualty clearing stations that, in proportion as the latter have increased, the need for the stationary hospitals has diminished. Those that are at the front are commonly engaged more in the treatment of the sick than of the wounded, or else in treating some special class of case, such as injuries of the head or shell shock.

X Rays.

At the beginning of the war *x* rays were not supplied at the front, but, coincidently with the development of operating work in the casualty clearing stations, the need of these became apparent. At first mobile *x*-ray vans were supplied, but, as demands for these increased, it became necessary to supply stationary plants as well, more especially to those casualty clearing stations to whose share it fell to do most of the operations; and, not only have *x* rays been of great service in guiding the operator, but in many of the abdominal wounds where the missile has been retained they have been of the greatest service to the surgeon in deciding whether or no operation should be done at all. In many other cases, such as some of the wounds of the head or of the knee-joint, it has been found better not to undertake an operation without a preliminary *x*-ray examination, so that in the present stage of development of surgery at the front the *x*-ray plant has become essential for the work of the casualty clearing stations.

Anaesthetics.

At the beginning of the war chloroform was in general use, but it was evident that there were many objections to its universal application, and other agents were soon employed as well.

Ether has been largely used, and was formerly administered by the open method, but experience has shown that it is often inadvisable to use it thus because of its tendency to irritate the air passages. For at least six months of the year the men who are exposed to the wet and cold in the trench area are suffering in very large numbers from catarrhs of varying degrees of severity, and in many of them these are accentuated by the further exposure which follows on a wound, especially when a man falls or lies in mud or water. The result is that the administration of any anaesthetic commonly sets up so much bronchial irritation that the patient's life is endangered by an attack of bronchitis or bronchopneumonia. These complications are specially dangerous in cases of abdominal wounds where abdominal respiration is difficult and where coughing up of mucus is often impossible because of pain or intestinal distension. It is indeed a fact that a very large proportion of all the deaths following abdominal wounds and operations are due to lung complications, and these injuries are at least twice as fatal in the winter as in the summer.

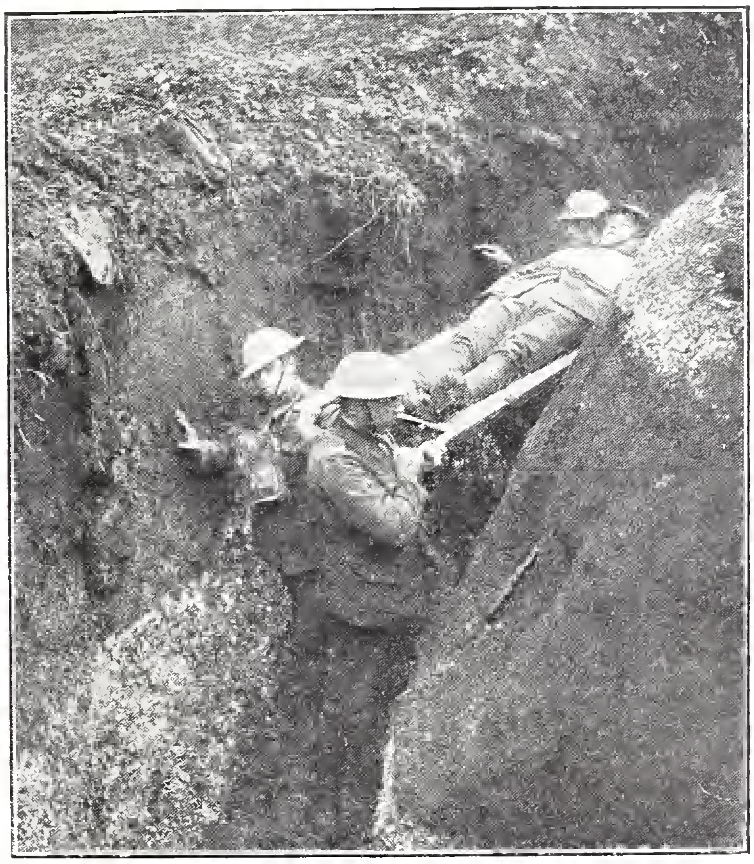


Fig. 2.—Handling a stretcher round a corner of communication trench.

Dr. Shipway's apparatus for the administration of warm ether vapour has been of the greatest value under those circumstances, and it is in common use in all the clearing stations. We have found that it possesses the following advantages:

1. There is very little secretion of mucus or saliva, and the patient is very quiet during the operation.
2. There is less sickness, probably because of the lessened quantity of mucus swallowed.
3. There is much less tendency to bronchitis and pneumonia.
4. The ether used is not more than one-third of that employed by the open method, and, as a consequence, it bulks less largely in transport.
5. Patients suffering from shock or haemorrhage can be pulled through an operation with less collapse than by other methods.
6. It can be connected with an oxygen cylinder, and the ether vapour can be administered in combination with oxygen in cases of shock.

The subject of the administration of anaesthetics at the front is decribed more fully in the paper by Captain Geoffrey Marshall printed on a later page.

The Use of Antiseptics.

It may be stated in general terms that it is the custom at the front to use antiseptics in the treatment of wounds, both at the field ambulances and the casualty clearing stations. No attempt is made to use antiseptic agents to disinfect the wounds on the field at the time of injury, for all who know the character of the wounds and the conditions of the wounded men, are agreed as to the complete futility of all such efforts, even if this had not been completely demonstrated during this war. But experience has also shown that in France and Belgium the wounds are so heavily infected from the soil that it is most necessary in all but the smallest wounds to excise very freely all the exposed and torn tissues which have been killed or else partially devitalized by the injury, and which are ingrained with dirt or portions of clothing. If this treatment is not carried out very thoroughly and carefully, and if free drainage is not secured, the gravest forms of sepsis may commence in serious wounds in a very few hours. It is common experience that if a badly wounded man cannot be rescued and brought into the field ambulance until after the lapse of twenty-four or thirty-six hours, the wound is often already so badly infected and the patient himself is in so toxic a state that surgical treatment has but little chance. It may be said truly that the most important alteration in treatment since the early days of the war is that excision of damaged tissue has become the routine method and that the earlier it is carried out the more likely it is to be successful.

"Eusol" and "Dakin's Fluid."

Very many antiseptic agents have been employed, and there is naturally some diversity of opinion as to which is the best. There is no doubt, however, that at the present time hypochlorous acid in the form known as "eusol," or the hypochlorite of soda in the solution known as "Dakin's fluid," are more extensively used than any others. The method of Dr. Carrel has been increasingly employed for the past year, and wounds treated in this way have done exceptionally well, although it is not always possible to employ the method universally at a time when the wounded are in very great numbers. At other times there is no difficulty, and in order to establish continuity of treatment Dr. Carrel's method is freely employed on every ambulance train taking wounded to the base hospitals.

Hydrogen Peroxide.

This is not highly esteemed as a potent antiseptic, but it is of great service in loosening adherent dressings, and so preventing pain and injury to the soft tissues by forcible separation of gauze or wool.

Carbolic Acid.

At an early stage of the war, and in consequence of representations made by surgeons in England, attempts were made to sterilize recent wounds by pure carbolic acid. They entirely failed to achieve this object, but solutions of a strength of 1 in 20 or 1 in 40 are in common use, and many surgeons have had a very favourable experience in using equal parts of solutions of carbolic acid and hydrogen peroxide.

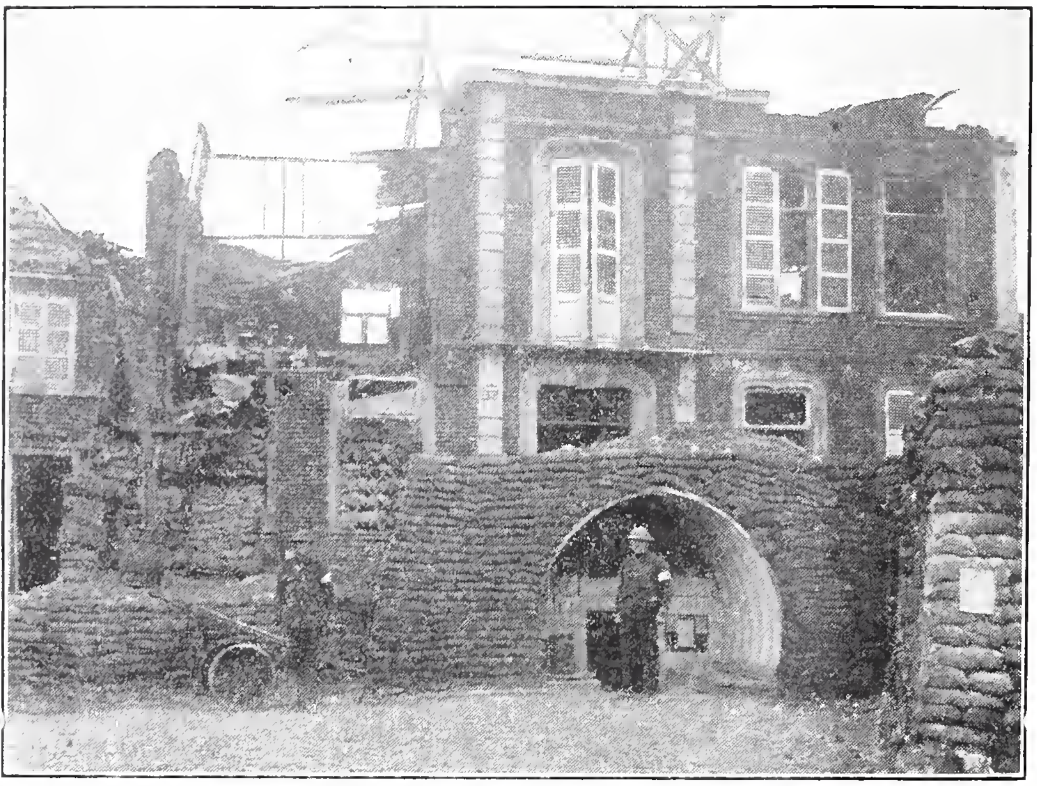


FIG. 3.—Advanced dressing station of field ambulance.

Sodium Chloride.

The hypertonic salt solution has not proved successful at the front, and at the present time is hardly used at all. The wounds treated by it were usually very slow in healing, and the granulations were generally pale, flabby, and much overgrown. There has also been a good deal of evidence to show that secondary haemorrhage is not nearly so frequent an occurrence since hypertonic saline has been displaced by other antiseptics. This is not at all surprising when it is considered that rapid cicatrization is the best safeguard against this complication.

The salt pack largely used at Rouen is also to a great extent supplanted by the employment of "eusol" and "Dakin's fluid." It is, however, at the front a useful method of treatment of large open wounds in patients who are in transit by train. It does not need to be disturbed for several days, and when there are large numbers of wounded to dress this is a very great advantage.

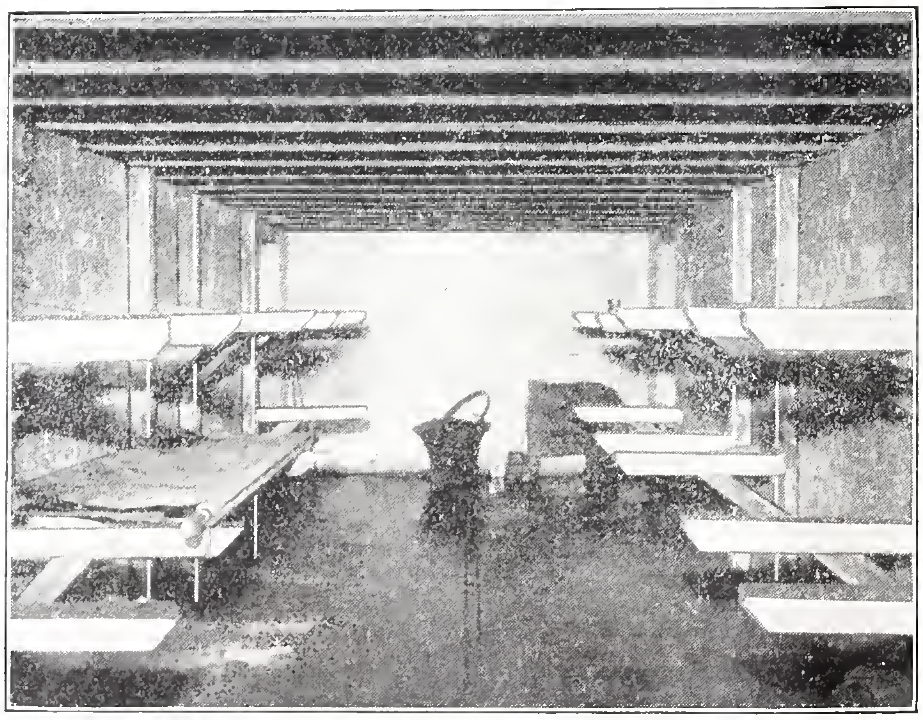


FIG. 4.—Interior of advanced dressing station.

B.I.P.

The mixture of bismuth subnitrate, iodoform, and paraffin, recommended by Professor Rutherford Morison for suppurating wounds (B.I.P.), has also been used for the past few months on recent wounds of the soft tissues, and also in cases of fracture. The results have been good, and encourage the further use of this remedy at the front. The fact that the wounds do not need dressing for several days gives it the same advantage as the salt pack, while its use permits of an early closure of the wound, and this is an additional advantage.

SHOCK, AND THE CONDITION OF WOUNDED MEN.

The condition of wounded men necessarily differs as wounds are more or less severe, but in even slightly wounded men there may have been much bleeding, exposure to cold, want of sleep, or want of food. If to these are added severe pain and the exhaustion due to a hazardous journey over broken roads, it is easy to appreciate that very many patients arrive in a state bordering on collapse. Experience has shown, as a result of knowledge of these conditions, that it is not possible to estimate accurately the real condition of the patient until he has been rested and warmed, and has taken food; and especially in winter time the most important of these remedial measures is undoubtedly warmth. This may be applied by warm blankets after the removal of wet clothes, or by hot bottles. But in more severe cases we employ a "light bath" of electric lamps beneath a cradle, or else a "hot-air bath" extemporized by leading under the bedclothes a pipe connected with a primus stove. Hot liquid food is good if the patient can take it, but he is often nauseated or actually sick in the worst cases of shock, and then small enemata with brandy are very useful. Warmth and rest are, however, of more importance than nourishment, and if the patient goes to sleep, as he very often does, it is best to leave him undisturbed for some time.

PRIMARY AMPUTATIONS.

Unless a man is bleeding it is usual to treat him as has just been described before any operation is performed, but it is often necessary to postpone amputation for as long as a day, or even two days, if the removal of the limb is to be done at the thigh. Many men will survive if they are allowed sufficient time to get completely over the shock of the injury and its attendant conditions, who would certainly die if subjected to immediate operation, and the more experienced the surgeon the less is he likely to hurry on a severe primary amputation.

It is, of course, evident that delay in removing a badly smashed limb may result in dangerous sepsis, and there is no doubt that the threat of gas gangrene may necessitate operation earlier than might be wished. Much must therefore of necessity be left to the discretion of the surgeon in each case, and, as it is only after a considerable experience at the front that really sound opinions can be formed, it is very necessary that those who have not had this experience should seek the advice of those who have before a decision is come to in a doubtful case.

Other questions concerning the treatment of shock and the use of saline infusions are dealt with in Captain Marshall's communication on anaesthetics at the front.

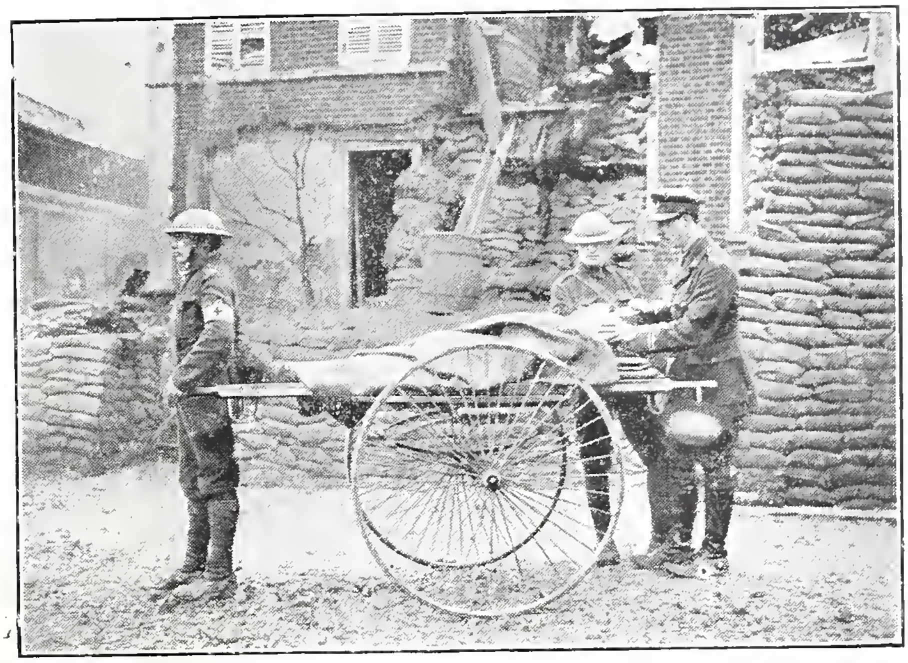


Fig. 5.—A wheeled stretcher.

When the condition of the limb and of the patient permit, a primary amputation should be performed by one of the recognized methods practised in the usual circumstances of civilian surgery, suitable flaps being provided. It is, however, never right to neglect drainage of the stump, and this should always be secured by the use of a large drainage tube, at any rate for a period sufficient to ensure that no serious sepsis exists.

The seat of amputation has been much discussed, but in our experience the best general rule is that as much of the limb as possible should be saved, quite regardless of the typical "seat of election" as prescribed in former years; primary amputations through joints are, however, as a rule to be avoided.

Departure from these ideals may be necessary, either because of the condition of the patient himself or of his limb.

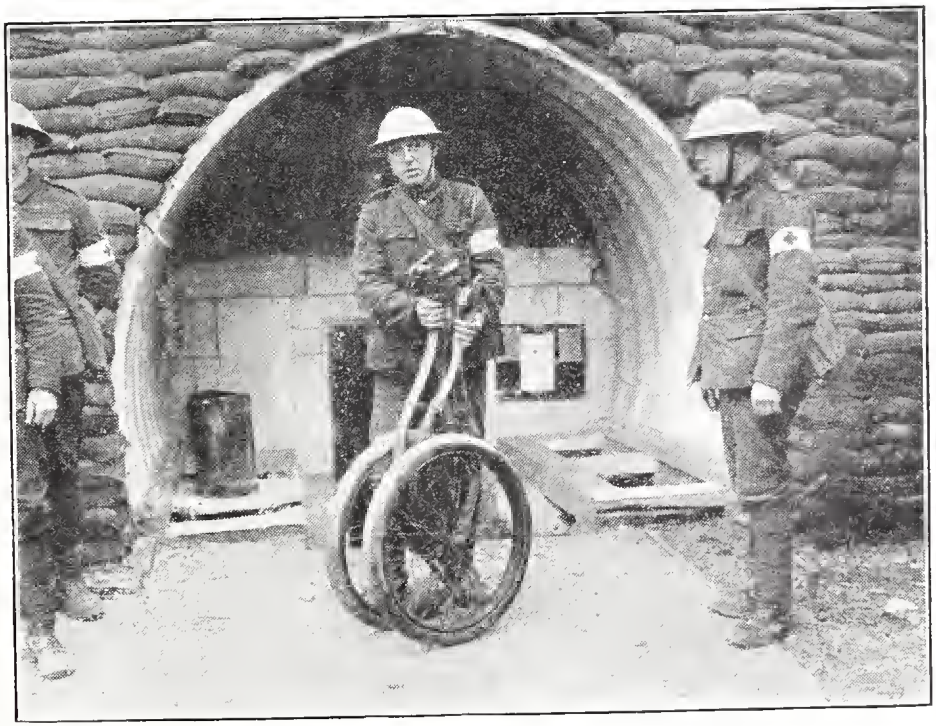


Fig. 6.—To show how compact the wheeled stretchers are when closed.

If the patient is desperately ill from the combined effects of loss of blood and other complications his condition may be such that the additional shock of a high amputation may be quickly and inevitably fatal. In a pulseless patient who has a numbed and still oozing limb the best thing is to remove it as quickly as possible by cutting through the soft tissues at the site of fracture, subsequently clipping away torn and ragged tissues and tying the main vessels.

Not more than ten minutes need be spent on such an operation, and, if it is conducted under the influence of gas and oxygen anaesthesia, many apparently hopeless cases can be saved, for there is very much less shock than would be entailed by either a longer operation or by the cutting though healthy and sensitive skin and muscle higher up the limb. In such a case the making of a suitable stump must be left to a future time.

In another class of case the leg or the forearm may be smashed beyond recovery, while the thigh or the upper arm is the seat of other severe wounds complicated by the presence of mud, of portions of shell, or of clothing. It is quite unwise in such a case to amputate high up the limb, and it is best to perform a "flush amputation" close above the fracture, and again leave to the future the formation of a useful stump at a time when the damaged tissues have recovered. If this is not done, not only is the patient exposed to more severe shock by a high amputation, but his stump may slough and a yet higher up removal may be necessary if he ultimately does survive.

Wound Infections.

It is well known that in France wounds are liable to be very heavily infected by numerous pathogenic organisms, and inquiry from surgeons who have had experience in other theatres of warfare enables us to say that, especially in Egypt and in the Dardanelles, the gas gangrene and tetanus infections were notably much less common than they are in France.

While no time of year or condition of weather brings immunity, it is very evident that wet weather and mud are far more dangerous than summer weather and dust; and this danger is much increased when patients are wounded in very cold weather and are thoroughly chilled before they can be brought in. Most surgeons are also agreed, that the coldness and lowering of vitality caused by severe haemorrhage have a similar predisposing effect on microbic infection, and it will be found that wounded men are attacked by tetanus and gas gangrene in proportion as the various conditions exist which are inimical to the human organism. It has also been noted that gas gangrene has often affected wounds in patients who have subsequently developed tetanus also.

GAS GANGRENE.

This disease appeared very early in the war and was a very unpleasant surprise to the surgeons. It had not been described as a usual complication of gunshot wounds, and though seen occasionally in civil life, so that its etiology was known to a certain extent, it was sufficiently unfamiliar to render an accumulation of experience necessary for its proper treatment.

Two clinical types of the disease were recognized early and were named "gaseous cellulitis" and "massive gas gangrene." The former term was applied to the milder cases in which the cellular tissue round the wound was considered to be the primary seat of the disease; the latter term to those cases in which the whole limb was rapidly affected and died. The milder type of the disease was treated by incisions and drainage, the severer type by amputation.

From a clinical point of view it was found that the conditions that favoured the onset of the disease were: (*a*) The retention of extravasated blood and wound secretions, (*b*) interference with the circulation, (*c*) the presence of large masses of partially devitalized or dead tissue, (*d*) extensive comminution of long bones, (*e*) the presence of particles of clothing in the depth of the wound. Each of these observations was quickly turned to account in the treatment of cases in which the disease might appear.

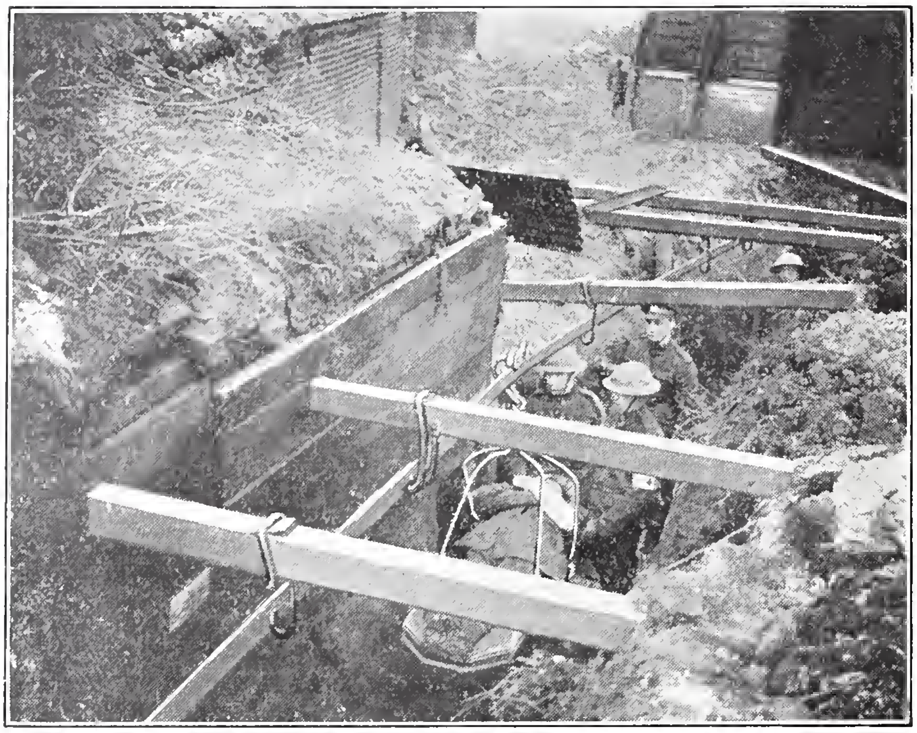


Fig. 7.—Overhead railway ambulance trolley.

Retention of Blood and Secretions.

The avoidance of the retention of blood and secretions necessitated the employment of some sort of dressing that would not dry and cake during the transit of the patient to the casualty clearing station and from there to the base. Thus the dry gauze and wool dressing was abandoned for one that would keep moist and favour the discharge of blood and serum. It did not seem to matter what chemical was used so long as the dressing remained moist.

Interference with the Circulation.

Interference with the circulation was brought about in several ways. First there was the tourniquet. Every effort was made to dispense with this instrument, and where this was not possible the patient was taken with all celerity to the nearest place where the haemorrhage could be stopped. Circular bandages were found also to be a source of trouble, especially when the bandages took the form of a gauze dressing wrapped round and round the limb, which mode of application was very tempting in treating multiple wounds.

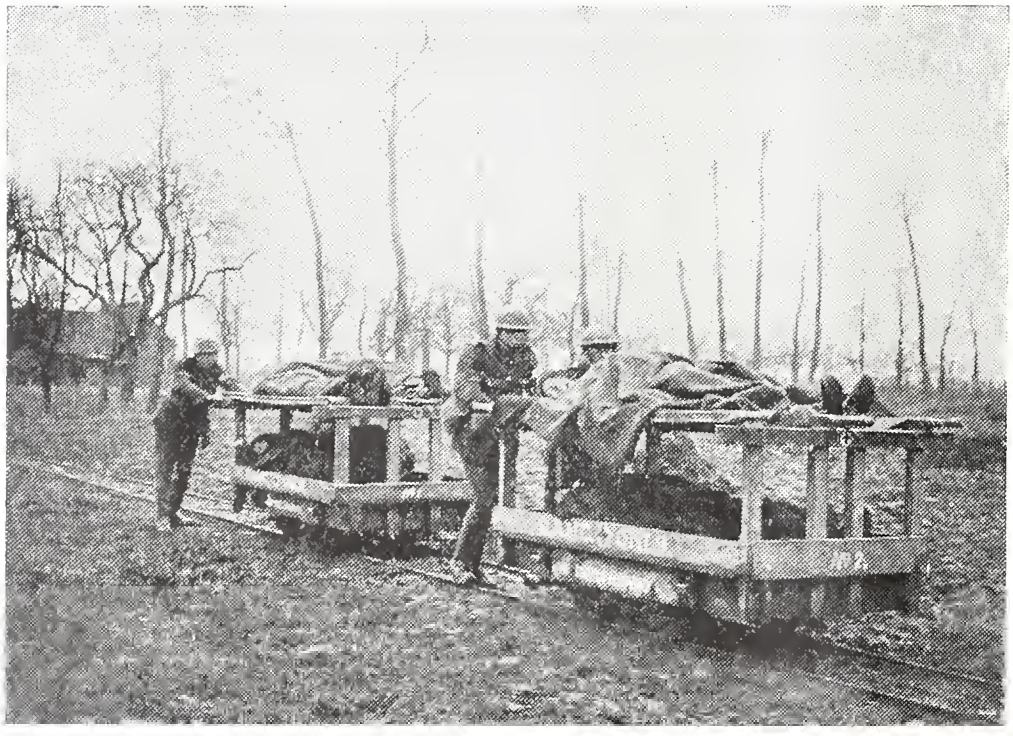


Fig. 8.—Two light railway ambulance trolleys.

In simple flesh wounds it was easy to arrange that the bandages and dressings should be loosely applied, but in the case of fractured lower limbs it was necessary to obtain some fixation of the limb, for the movement of the bones was not only painful to the patient, but calculated to produce further damage to the soft parts. The adoption of the Thomas splint largely solved this part of the problem, but there were and still are difficulties in the way of its adoption as far forward as is desired. Some fractured lower limbs are still sent to the casualty stations with the old Liston splint; the rapid evacuation of all wounded that now pertains has, however, lessened considerably the disadvantages of this splint.

The arrest of the blood supply to a segment of a limb by the rupture or thrombosis of an artery has so far baffled the surgeon. Attempts were made by suture and the employment of Tuffier's tube to restore the circulation, but, so far, have not met with the success that was hoped. All that can be done is to favour the collateral circulation in every way.

Devitalized Tissue.

The devitalized tissue that formed a nidus for the development of the gas-producing organism was got rid of by excision through the opened wound, and as the attention paid to this mechanical cleaning of the wound became greater so did the results improve.

Bacteriology.

While surgeons were working out the best methods of treatment the bacteriologists were studying organisms found in the wounds, which were nearly all infected with many varieties of amoebic bacilli. Many bacteria were found, but the blame could not be definitely fixed on any one organism, and in many cases there was a mixed infection. The *Bacillus aërogenes capsulatus* of Welch was found present in the greater number of cases. The interesting and important observation was, however, made that the numbers of gas-producing organisms steadily decreased with the lapse of time, whilst the pus-producing organisms increased. This bacteriological fact corresponded with the clinical observation that the likelihood of gangrene occurring became steadily less as the wound became older and suppuration more obvious.

Our knowledge of the disease, both from a bacteriological and clinical point of view, remained much in the above condition for a long time. The following points were always being debated:

(*a*) What were the organisms capable of producing the disease?

(*b*) Could any one bacterium alone cause the gangrene?

(*c*) If not, what mixture might be necessary and what part did each organism play in the clinical picture?

(*d*) What tissue was primarily and chiefly affected?

(*e*) How did the disease start, and what was the cause of the extraordinary rapidity with which the condition spread?

(*f*) What was the reason of the return of the disease after an amputation through apparently healthy tissue?

(*g*) What was the nature of the poison that caused the death of the patient?

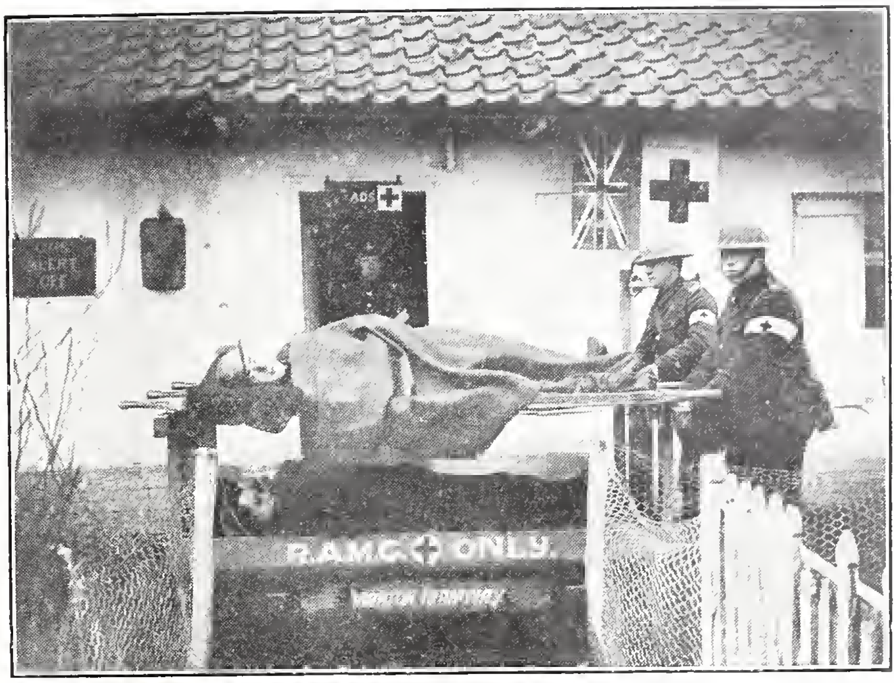


Fig. 9.—Light railway stretcher carrying four wounded.

It cannot be said that a complete answer to any of these questions has been found, but some suggestive work has been done. For answers to the first three questions (*a*), (*b*) and (*c*), the reader is referred to the statement by Captain Herbert Henry, R.A.M.C., which will appear later.

In answer to the fourth question (*d*), Kenneth Taylor, a member of an American ambulance near Paris, stated that he believed that the disease was essentially a disease of the muscles. Some clinical observers working in the British army have supported this view It was found that gas gangrene seldom produced serious symptoms unless muscle was infected, and that the muscles might be killed and gaseous while the intermuscular planes remained little altered. It was also pointed out that single muscles and muscle groups were very apt to be picked out while others remained healthy. It was noticed that invaded muscles were nearly always muscles that had been wounded. The disease would spread up and down these, but showed little disposition to pass to their uninjured fellows. Advantage was taken of these facts to excise those muscles affected, and thus arrest the disease without recourse to amputation.

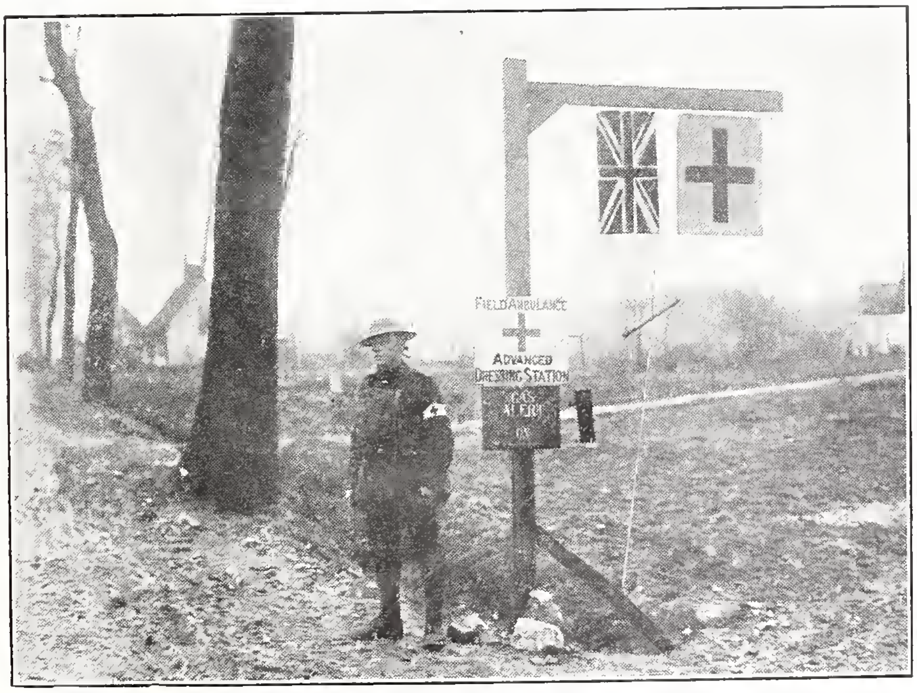


Fig. 10.—Outside an advanced dressing station. Each of such is marked with flags as shown.

It was further recognized that crepitations and colour changes in the skin might be comparatively late manifestations of the disease and that death of the muscles might take place before these signs were evident. Vomiting, a rapid pulse, and a tympanitic condition of the limb came to be more and more relied on as symptoms of the disease and as an indication for immediate interference. It became apparent that the discoloration of the skin was due to arrest of the blood supply, brought about by the death of the underlying muscles, and that crepitation was largely due to a forcing out of the gas generated in the muscles into the intermuscular planes and subcutaneous tissue, and that the crepitation in muscle was really a very late stage in the process of disintegration.

When gangrene occurs in a segment of a limb distal to the point at which the main vessel has been obstructed, all the muscles are affected, and the process appears to be similar to that which takes place in the body after death, though the actual route by which the organisms gain entrance is undecided.

As muscle became infected it was found that the normal purple-brown colour altered to a dirty brick red, and that this change took place before the muscle became crepitant to the finger. Advantage was taken of this observation to distinguish between healthy and hopelessly infected muscles.

In some cases the connective tissue was found to be the seat of the disease, especially the retroperitoneal tissue when infiltrated with blood.

Metastatic infections at the site of saline injection were described by McNee, Mullally, and other observers. This observation is important, for it may explain in part the return of the disease after amputation.

(*e*) When all wounds were infected by the gas producing organism, why should some pursue a normal course and others give rise to gangrene? If it is accepted that this disease is mainly one of muscle, some measure of explanation is afforded. The question still remains, Why do some muscle wounds lead to gas gangrene and others not?

Most observers believed that the organisms could only live in dead muscle. In every muscle wound there is dead muscle; but if the diseased condition should spread, the organism, on the assumption that the bacillus could only live in dead muscle, must be able to kill the muscle. How did it do this?

D'Este Emery, who had been impressed with the repeated return of the disease in amputation stumps and its rapid spread, in a most suggestive paper showed that the poison produced by the *B. aërogenes capsulatus* had a powerful negative chemiotaxic influence on the leucocyte. These experiments performed *in vitro* were in strict consonance with the histological observation that there is no leucocytosis where gas gangrene is active, and that the leucocytes only appear when the disease is in process of arrest. D'Este Emery's observation appeared rather to explain the non-arrest of the disease than to account for its rapid spread.

FIG. 11.—The ventilating shafts of an advanced dressing station.

Taylor thought that there might be two factors. In the first place, as the toxin produced by the organism was found to be little toxic, he suggested that the toxin elaborated by the breaking down of the muscle might cause the death of the contiguous muscle substance. He also suggested that the presence of the gas generated produced disintegration of the muscle, and thus made it a pabulum for the bacilli.

McNee and Dunn have offered the following explanation:

The bacteria which are responsible for the causation of gas gangrene lead their normal existence as saprophytes in decaying organic material. When these organisms obtain access to tissues which have already been devitalized by loss of blood, they find an environment entirely suited to their growth, and proliferating readily, they produce gas and liquefaction of the tissues. This process is simply the uncontested invasion of dead material by bacteria, and it is entirely similar to what may occur in the whole body after death. The problem which has presented greater difficulties, and which possesses the graver interest, is the manner of involvement of living tissues by gas gangrene. The causal organisms are known to exhibit only slight general pathogenicity. If pure cultures of them are injected subcutaneously into animals the effects may be surprisingly slight and transient. The organisms are most frequently unable to establish themselves in the healthy undamaged tissue, and are soon destroyed by phagocytic action. The effect, however, is considerably greater if the bacilli are injected into muscle, and especially if some damage is caused at the site of injection. In this way the whole picture of a spreading gas gangrene has been produced in the leg of an animal by inoculation of a pure culture of the *Bacillus aërogenes capsulatus*.

FIG. 12.—Advanced dressing station. Where the patients are received.

The mere presence of the anaërobic bacilli in the muscle does not necessarily entail death of the fibres, for the organisms have often been recognized in sections, and have been successfully cultivated from portions of muscle which were remote from the gangrenous area and still contractile. How, then, does death of the fibres arise?

The rapid spread of gas gangrene into living voluntary muscle depends mainly on the peculiar anatomical conformation of that tissue. At the advancing edge of the gangrenous process only a limited number of muscular fibres are necrosed. The dead fibres, in contrast with the normal ones around them, are separated off from their vascular sheaths by spaces filled with fluid. As the stripping of these sheaths is coincident in extent with the histological appearance of coagulation in the fibres, it is suggested that coagulation is caused by a toxic fluid permeating and filling the sheaths. At this stage organisms are not more numerous than may be found in living muscle higher up. The toxic material is presumably derived from the action of organisms on the tissues lower down. In a slightly more advanced stage the above alteration is found to extend to all their fibres and their sheaths, and bacilli are met with in greater numbers. Later still the whole of the tissue elements are invaded by the bacilli, and undergo extensive distortion and disintegration.

The above outline suggests a process which, once started, may maintain itself indefinitely, for the progressive death of the muscle permits further luxuriant growth of the organisms and extension of their lethal effects. The sugar content of muscle is favourable to the growth of the anaërobes, and the result is the production of a highly toxic fluid. The primary infection no doubt occurs in the wound in lacerated ends of fibres which are healthy in the rest of their length, and the establishment of a gangrenous process is permitted by this continuity of structure.

RECURRENCE AFTER AMPUTATION.

(f) In discussing the question why the disease sometimes recurs in an amputation stump when the operation has been done through apparently normal muscle, it seems necessary to distinguish between two types of amputation:

1. An amputation through the upper healthy part of muscles, the lower portions of which are gangrenous.
2. An amputation through muscles which are normal throughout their length, as in removal of the thigh for gangrene of the leg.

McNee and Dunn have shown that the *B. aërogenes capsulatus* is found in healthy contractile muscle far beyond the gangrenous edge. As the only clinical test we have of healthy muscle is its normal colour and its contractility, it may happen that an amputation through such muscle may still leave numbers of bacteria in the stump.

This explanation does not seem sufficient. The fact that metastatic infections appear from time to time shows that bacilli may be floating in the blood. Should this happen in a case submitted to amputation it is possible to conceive that they may find a resting place in the muscle damaged by the amputation and thus start the disease afresh.

(*g*) At present the nature of the poison and its mode of action are unknown.

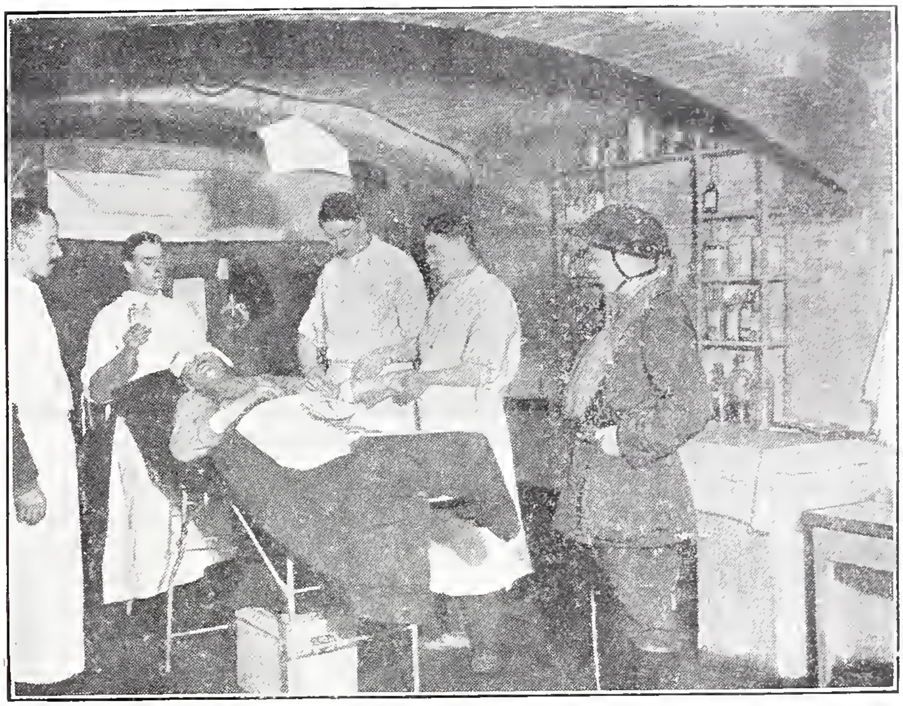


FIG. 13.—Interior of an advanced dressing station: Operating theatre.

TREATMENT.

The treatment in vogue at the present moment, and based on the above observations, may be summarized as follows:

Preventive.

The wounds are opened up and all dead tissue and foreign bodies removed and adequate drainage provided. The circulation is encouraged in every possible way.

When the Disease is Established.

(*a*) When gangrene appears in a segment of a limb where the main blood supply has been interrupted higher up the only treatment is amputation.

(*b*) When the gangrene appears in the muscles or muscle groups actually wounded. Here the treatment must depend on the condition of the patient. If this is good the wounds are freely opened and the affected muscles or muscle groups removed. The test employed to distinguish dead from healthy muscle is the want of contractility or the presence of the brick-red colour.

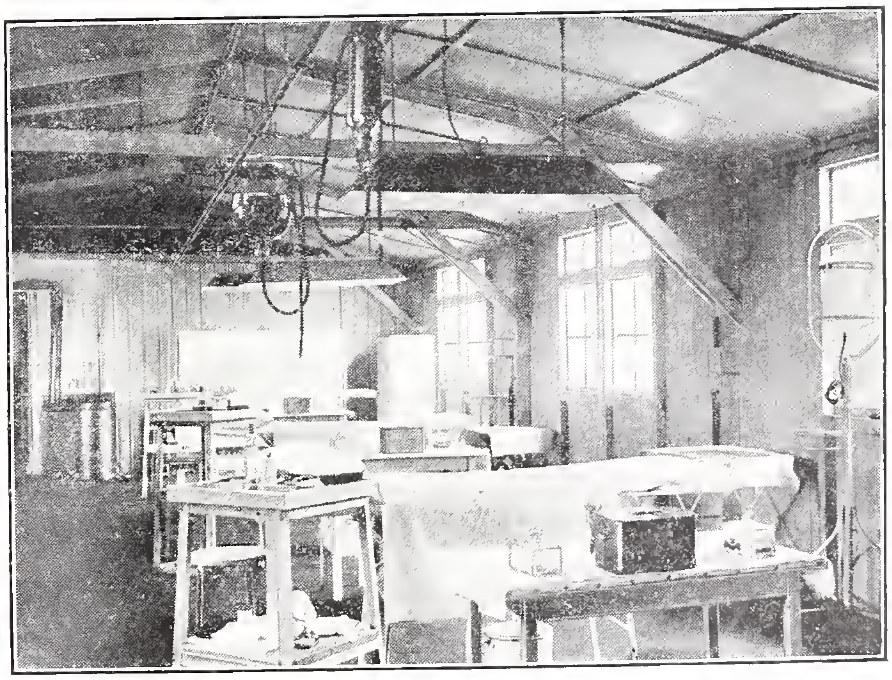


FIG. 14.—Operating theatre at a casualty clearing station.

Even with the gangrene localized to certain muscles amputation is the safest course if the general condition is bad, and it is seldom possible to save such a limb if the bone is broken.

ABDOMINAL WOUNDS.

SURGICAL OPINION WHEN THE WAR STARTED.

For many years it had been held that the operative treatment of abdominal wounds was not to be advised under war conditions. This was partly due to want of success, as in the Spanish-American war, and partly to the fact that many military surgeons were opposed to extensive operating anywhere near the firing line; as abdominal surgery, to be successful, must be done at once, it is obvious that it could not be undertaken with success where all operations had to be postponed to a late period. Although the expectant treatment was the orthodox one when the South African war broke out, many surgeons at that time hoped to prove that it was wrong. Surgeon-General W. F. Stevenson even issued an appeal for the trial of operation. The result was, however, only to confirm former opinion, though this opinion was now held on two somewhat different grounds. One school held that the expectant treatment was in itself the right procedure, the other that it was the best that could be done in war.

Some believed that wounded intestine healed sufficiently often to warrant abstention, others believed that small gut lesions were practically always fatal, and that the success obtained by the "wait and see" policy was due to the escape of the bowel from injury, although the belly had been penetrated. The opinion that it is possible for the small gut area to be traversed by a rifle bullet without injury has been proved to be correct in this war. A study of the literature of the South African war, both private and official, makes the real reason for want of success in operating at once obvious—the cases arrived too late. It was not so much a question of the success of the expectant treatment as failure of the operative, and the two strikingly successful cases of resection of small gut (Neale and Tuke) were operated on within six and twelve hours of injury respectively.

The reason for the late operation was the nature of fighting in an unsettled country of great distances. The wounded could not be quickly brought to a hospital with the necessary appliances. To operate in the veld with what appliances were at hand was too disheartening. It was impossible to get even moderately good conditions. There was little or no water, and what there was was often too filthy for words—the water of dams. In addition, there was the plague of flies that settled on everything.

The conditions were utterly different from those that pertain at the present time. This is the first time since the rise of abdominal surgery that a great campaign has been fought in a settled country, and, what is more important still, with a fixed fighting line.

The small number of cases dealt with in the South African campaign was also a source of error, for in order to form an adequate idea of the efficacy of any treatment it is necessary to strike an average over a large series of cases.

The statistics of the South African campaign are very defective. Surgeon-General Stevenson in the official history of the war was only able to collect 207 cases of abdominal wounds. Among them it is stated that there were 26 laparotomies with 18 deaths, a mortality of 69.2 per cent., and according to Stevenson the mortality was really even worse. The total death-rate of all abdominal wounds quoted—operated and unoperated—is given as 30.4 per cent.

In the same author's most recent work, *Wounds in War* (1910), the mortality is shown as 51.6 per cent. for laparotomies, the total of cases remaining the same—namely, 207. In any case the figures are really too small to have any real value.

In this present war one of the difficulties of establishing the operative treatment was the run of bad luck which any operator might have to face. Even now, with conditions as nearly ideal as possible, a series of nine consecutive fatal cases may be met with. This must have a very depressing effect on any surgeon, especially on one who is not yet convinced that the operative treatment is in the main the best of all. Now nine abdominal cases means roughly about 600 wounded men, taking a moderate estimate of the proportion of abdominal wounds to total wounds.

As a matter of fact, in the South African campaign a casualty list of 600 wounded was considered a large one, and if an operator happened to encounter such a series of fatalities, it is not a matter of surprise that he should have had doubts as to the correctness of his procedure.

Statistics in the present campaign show that an operative mortality of 50 per cent. is a good result, but such a mortality in civil practice would be considered an awful death-rate to face. And yet it means, looking on the bright side, many lives saved.

The South African campaign may, then, be said to have left surgical opinion opposed to operation, but it must always be remembered that not only were there practically no shell wounds in that campaign, but also that the ogival bullet was a much less harmful missile than the sharp-pointed bullets of the present war.

METHOD OF TREATMENT IN THE EARLIER PERIOD OF THE WAR.

In the retreat from Mons and on the Aisne adequate provision for the performance of abdominal operations near the front was well-nigh an impossibility, and all that could be done was to send the wounded to the base with the least possible discomfort to them. When, in the ensuing winter, the line became fixed the circumstances were very different, and there soon developed a possibility of operating under good conditions. It was no longer a question of whether a man could be operated upon, but whether he should be operated upon. Still, however, a good deal of the old belief in the efficacy of the expectant treatment obtained for some time longer. A man wounded in the abdomen was sometimes kept in a dug-out in the trench system; often he was kept at a field ambulance, usually he was transferred to the casualty clearing station and there treated.

The customary mode of procedure was to put the man in the Fowler position, to improve the general condition by rest and warmth, to withhold food and water for three days and to administer morphine. The thirst, which was a distressing symptom of this treatment, was combated to a certain degree by rectal salines and mouth washes.

A tribute must here be paid to the great care and attention which the medical officers lavished on the patients. Certain officers were told off day and night to attend to them and everything possible was done to alleviate their suffering and to make them as comfortable as possible and to cheer them up. If anything could have got these men well the attention that they received would have done so, and it must be remembered that the medical officers who conducted the treatment were convinced of its efficacy.

This belief was strengthened by the behaviour of many of the patients, for some who were at first gravely ill, went through a period of improvement which often was very striking. It was in a way unfortunate but there is no doubt that improvement did take place, and so well were many of them that after several days they were evacuated to the base and arrived there sometimes in fair condition, although more often gravely ill. But the surgeons who had seen the cases leave the casualty clearing stations apparently on the way to recovery could not at first bring themselves to believe that they did badly at the base, and if evacuation had not been necessary and it had been possible to keep patients at the casualty clearing stations the expectant treatment would not have survived as long as it did, for medical officers would have seen many such cases become worse and worse, and in the end—die.

COMMENCEMENT OF THE OPERATIVE TREATMENT.

Although rest treatment was the rule, some attempts at operation had been made as early as November, 1914; but it was only when the more complete development of the casualty clearing stations provided satisfactory conditions that surgeons felt that their opportunity for operating had arrived, and during the winter of 1914–15 operations were done by several medical officers. But the early results were undeniably bad—so bad that most people abandoned the attempt, and the reasons for failure were no doubt both the late arrival of the patients at a place where an operation could be performed and the want of knowledge which later on was acquired by experience alone, for there was no literature which dealt with such injuries as the surgeons were now called on to treat, and each man had to learn the best methods for himself.

Owen Richards was the first to publish results of operative treatment in the British army.[1] His first operation was performed on January 28th, 1915, and the first successful operation, that of a resection of 2½ ft. of the small intestine, was performed on March 18th, 1915, thirty-six hours after the injury was received.

In May, 1915, an inquiry into the causes of death after abdominal wounds established the following facts:

1. That the injuries were as a rule of such a nature that recovery must be a very rare event.
2. That haemorrhage was a chief cause of early death.
3. That bullets produced very extensive injuries.

It had always been granted that haemorrhage was the chief cause of early death, but the advocates of expectant treatment seem to have focussed their attention more on the danger of peritoneal infection and the possibility of its localization or disappearance than on the possibility of spontaneous arrest of haemorrhage.

The discovery that bullets produced extensive gut injuries was also of great importance, as much stress had been laid on the smallness of the lesions produced by the modern small bore bullet, and the expectation of spontaneous recovery of gut lesions had been based on the quite erroneous assumption that such projectiles were comparatively innocuous.

The re-establishment of the fact that haemorrhage was the chief cause of early death was of great importance, as it showed that only rapid evacuation afforded any hope of combating such a condition. Arrangements were accordingly made to ensure that all patients suffering from abdominal wounds, and who were not too ill for transport, should be sent by special motor ambulances to the clearing station and not retained in the field ambulance. At the same time meetings of the medical officers of field ambulances and regiments were held at different centres, so that it could be demonstrated to them that the lesions of the hollow viscera were much more extensive than they had believed, and that in such conditions early operation gave the only chance of recovery. The result of this diffusion of more accurate knowledge was soon seen in the much earlier arrival of patients, and the greatest praise is due to all those who combined in the effort to rescue the men and convey them to the rear as rapidly as possible. The consequences of these improvements soon became apparent in the saving of many lives, and the operative treatment, now that it was placed under favourable conditions, very soon won for itself the confidence of the medical service, and quickly became universally adopted.

Where to Operate.

The British practice has been to operate a short distance behind the line, and the wisdom of this has been demonstrated. Here it is possible to operate under good conditions and to nurse the patient among cheerful surroundings for a week or more subsequently.

The casualty clearing stations have, as a rule, been used for this purpose. If for some local reason it has not been possible to put one sufficiently far forward at any one part of the line, a small operating centre has been opened for the reception of abdominal and other urgent cases. The influence of time is shown very clearly in Table I.

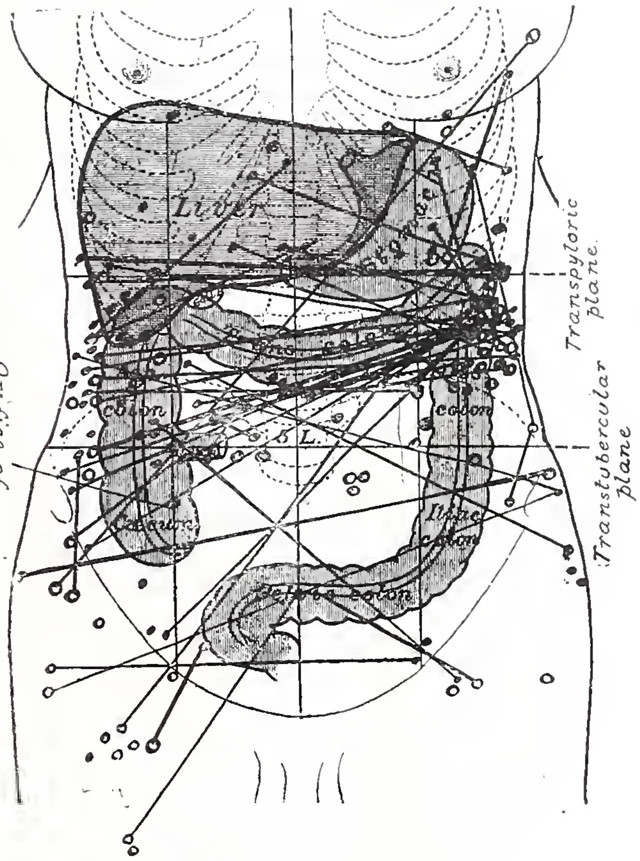


DIAGRAM 1.—No operation. Died.

TABLE I.—*Effect of the Time Elapsed between Receipt of the Wound and Arrival at the Operating Centre.*

Total number of cases 591.

Hours :	0–2	2–4	4–6	6–8	8–10	10–12	12–14	14–16	16–18	18–20	Over 20
To base ...	3	30	75	55	34	19	7	4	11	4	27
Died ...	2	30	53	59	41	23	10	12	15	11	56
Total ...	5	60	128	114	75	42	17	16	26	15	83

A very significant fact comes out from a study of the next table (II)—namely, that of 145 patients with a pulse above 120 only 16 recovered.

TABLE II.—*Prognosis from Pulse-rate.*

Total number of cases 577.

Pulse up to :	60	70	80	90	100	110	120	130	Over 130
To base... ...	1	7	23	30	108	27	37	7	9
Died	1	2	13	18	39	38	88	37	92
Total... ...	2	9	36	48	147	65	125	44	101

Table III shows that bullet wounds are highly fatal.

TABLE III.—*Relative Mortality of the Different Projectiles.*

Total number of cases 629.

	Bullet.	Shell Fragment.	Shrapnel.	Bomb.
To base	91	105	15	60
Died	106	154	40	58
Total	197	259	55	118

TABLE IV.—*Relative Number of Different Projectiles and Proportion Retained.*

Total number of cases 834.

	Bullets.	Shell Fragments.	Shrapnel.	Bombs.
Passed out ...	203	30	15	6
Retained	131	254	67	128
Total	334	284	82	134

The Most Dangerous Wounds.

The chart (Diagram 1) shows the entrance wound or the course of the projectile in cases that arrived too bad for operation.

Possibility of Escape of Hollow Organs after Penetration of the Abdomen.

Diagram 2 shows the course of the projectile or its place of entrance in those cases in which coeliotomy proved that no hollow alimentary viscus had been penetrated. In some such cases many organs were bruised.

A certain number of cases of rupture of a hollow viscus without abdominal penetration have occurred, and have made it advisable to explore the intestine in some instances even when the whole thickness of the abdominal wall was not penetrated by the missile, but where the symptoms have pointed to the probability of a lesion of one of the hollow viscera.

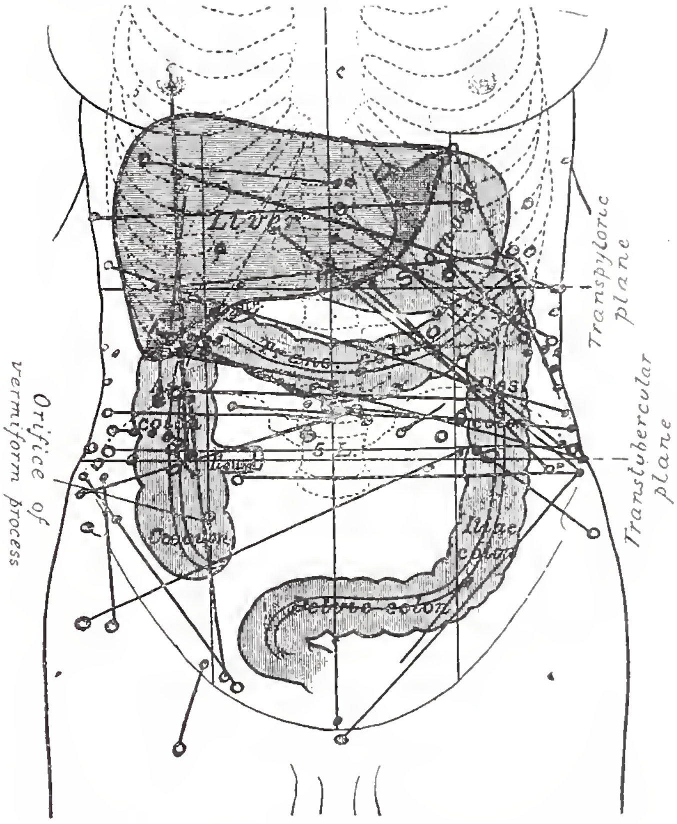


DIAGRAM 2.—Coeliotomy. No wound of any hollow viscus.

General Line of Treatment.

The practice is now to operate on all cases unless there is some reason to the contrary, and to operate on principle rather than on the indications by symptoms.

The cases on which operation has been found, as a general rule, to be inadvisable may be divided into two classes—(1) those in which solid organs alone are wounded and in which there are no signs of continuing haemorrhage, and (2) cases arriving after thirty-six hours.

The liver furnishes by far the greater number of cases in Class (1). This organ is the only solid organ in which it is possible to say from inspection that no other organ is wounded. In the other solid organs, such as the kidney and spleen, the likelihood of hollow visceral injury nearly always compels exploration. Were it not for this contingency, the solid organs would require little operative attention.

In Class (2) the time for successful interference in the ease of hollow viscera has as a rule gone by, and the bleeding, from whatever source it came, has ceased spontaneously.

Before operation a period of rest has found favour with most people. This period is used to combat shock, for which purpose heat in various forms has proved by far the most efficient means.

When the missile is retained the position of the projectile should be ascertained by an *x*-ray picture, as its localization will influence the site of the exploratory incision. The incision should as a rule be placed by the side of the mid line and be of ample length. A transverse incision is much favoured by some for exploring wounds which traverse one side only of the body.

The question of the administration of saline is important. The subcutaneous injection of saline has found favour in the past, but it is coming to be recognized that very little is absorbed in a shocked man, and that this method presents no advantages over its administration by the natural orifices. If these are not available the intravenous method should be used.

Axioms of Operative Procedure.

Celerity is of great importance. The body heat must be preserved in every way. There should be the least possible exposure of the viscera, and the intestines should be kept inside the abdomen as much as is compatible with the necessary manipulation. The least possible should be done. All the intestine should be examined. Suture of the intestine should always be preferred to resection unless the latter is inevitable, or saves time, and experience has shown that a single continuous suture, applied so as to invert the peritoneum, is quite sufficient and perfectly secure. Linen thread or thin silk are both preferable to catgut, and care is required not to draw the stitches too tight. If resection is unavoidable, end-to-end anastomosis is preferable to lateral apposition as a rule.

Solid organs should be disturbed as little as possible, unless vessels have been opened. Excision of spleen and kidney should be practised with great reserve.

Through-and-through wounds of the liver are best left alone, but if the *x* rays show a large piece of shell or bomb in an accessible position it should be removed, for if left it generally causes dangerous sepsis in the organ.

Abdominal drainage is most probably of little use except in local lesions.

Artificial ani in the colon are to be avoided if possible.

Wounds of Special Organs.

Stomach.—Wounds of the stomach, though less severe than those of the small and large intestine, have proved decidedly more dangerous than was supposed. The fatal result has largely been caused by haemorrhage and shock and by complication with other visceral injury.

Small Intestine.—In the small intestine the multiplicity of the lesions and haemorrhage from the mesentery have been the chief causes of failure. As many as twenty lesions have been met with. In one case a successful result followed a resection of 6 ft. for twenty perforations (Captain Owen Richards). In another case fourteen lesions were sutured and followed by recovery (Captain John Fraser).

Large Intestine.—The large intestine wounds have been mostly fatal from sepsis of the retroperitoneal tissue in the case of the ascending and descending colons and from complicated injuries in the case of the transverse colon.

Rectum.—The rectum proper has not been wounded so often as would be expected, but has a high mortality.

Liver.—The liver shows a large proportion of recovery after operation, but many patients would have got well without operation.

Spleen.—The spleen injuries have not been very dangerous except where the lesions have necessitated excision, and the same may be said of the kidney.

Bladder.—Intraperitoneal wounds of the bladder show a mortality of 56 per cent. where uncomplicated, but those associated with small gut injury have proved exceedingly dangerous.

Causes of Failure.

Haemorrhage, sepsis, and shock have been the chief causes of death.

Haemorrhage has come from every vessel in the abdomen except the aorta. Principally it has proceeded from the mesentery and the pelvic vessels. On two occasions a rent in the vena cava has been closed—in one by the application of forceps (Captain Taylor), and in one (by Captain Sampson) by suture. The former recovered. In one instance the vena cava was ligated, but the patient survived only ten hours.

Sepsis.—Under this head are included peritonitis, retroperitoneal sepsis, and wound infection. It is unnecessary to say much about peritonitis. It causes death in the same way as seen in civil practice. Many attempts have been made to combat the so-called obstructive symptoms by enterostomies and short circuits, but with little if any success. It must be mentioned here that a certain amount of evidence has accumulated showing that some obstructive cases have as their basis a nervous traumatic paralysis. Retroperitoneal sepsis, accompanied or not by gas formation, has proved a great source of mortality. This has been obvious in the case of the colon injuries, but a recent series of *post-mortem* examinations by Captains McNee and Dunn has proved that such sepsis is frequently the cause of death where that death has clinically been put down to shock.

Shock.—This subject is dealt with in another place by Captain Geoffrey Marshall, but a word may be added here. It is very difficult to trace any definite relation between the amount of injury and the amount of shock. It can only be said that multiple injuries produce, as a rule, much shock. A severe intestinal lesion will not in all cases prevent a man from completing the task on which he was engaged or even from walking one or two miles, and many who subsequently die arrive at the hospitals in good condition. The pulse-rate table gives some indication of the patient's condition. Prolapse of the small gut seems to cause less disturbance than that of the stomach and colon. Haemorrhage is by far the most frequent cause of death, and as it is nearly always present, it is difficult to determine how much shock is due to this cause and how much to the accompanying injury. There is a certain amount of evidence to show that comparatively slight injuries of both kidney and liver will cause intense collapse, but such cases are not common. Sepsis of the retroperitoneal tissue without severe injury does cause the most intense shock.

Results.

The following table gives the results obtained by the operative treatment in a certain sector of the British line over a period of eighteen months. Practically every case that got to hospital is included, so that a true picture is presented, and the varying results produced by locality and different conditions are eliminated as far as possible.

TABLE V.—*Abdominal Wounds operated on in a Sector of the British Line during Eighteen Months.*

Total number of cases	1,288
Arrived moribund	250
Total mortality, excluding moribund ...	50.06 %
Total mortality, including moribund ...	60.02 %
Considered with view to operation ...	1,038
No operation advised	73
Total operations	965
Total operative mortality...	53.9 %
Total hollow viscera mortality	64.7 %
*Stomach mortality	52.7 %
*Small gut mortality	65.8 %
*Colon mortality	58.7 %

* Uncomplicated by wound of other hollow alimentary viscus.

It is very difficult to compare the present mortality with that of the pre-operative period. The whole method of evacuation has completely changed. The operative treatment has attracted to the casualty clearing stations all men wounded in the abdomen, so that those who would have died in dug-outs, at the advanced dressing stations, and at the field ambulances, now reach an operative centre.

Neglecting the more forward positions, a calculation made in the pre-operative days showed that the mortality at field ambulances and clearing stations was 70 per cent. In addition there were the deaths at the base, which raised the mortality to about 80 per cent.

There would therefore seem to have been an improvement of from 15 to 20 per cent.

WOUNDS OF THE HEART.

There has been one successful suture of a heart wound. It was performed by Captain John Fraser. The details are as follow: A bomb fragment entered immediately internal to the left nipple. There was a persistent and pulsing escape of rather dark blood. A probe passed upwards and towards the mid line evidenced a cardiac rhythm. The pulse was small and irregular; the patient distressed and cyanosed. A portion of the fifth rib and its cartilage was removed, and the fourth costal cartilage detached from the sternum. The pleura and fat were retracted, and the pericardium incised. The latter contained a quantity of dark blood. A small hole, the size of a pea, was found in the right auricle. By a suture the auricle was pulled up into the wound and the hole closed by two linen sutures. The progress was good, and the pulse, which had been 120, dropped to 90 on the fourth day.

The patient nine months later reported his health as excellent.

WOUNDS OF BLOOD VESSELS.

It may in the first place be noted that the conception of many surgeons of the size of the lumen and of the thickness of the wall of arteries in general has undergone a change in this war, and it has often been remarked by medical officers that the arteries are smaller and have slighter walls than was expected. No doubt the class of subject from which one gained an idea of the size of the normal blood vessels is so different from the class met with in war surgery that there was an exaggerated idea both of the size of the artery and of the thickness of its walls in healthy young adults.

Surgeons, knowing that they would have to deal with healthy arteries, hoped that many opportunities would present themselves for arterial suture, but unfortunately the opportunities have been few, and the injuries have rarely been of such a nature as to offer any prospect of success or even of trial of such treatment. Lateral suture both of veins and arteries has been done in a fair number of cases, and in two instances a lateral rent in the vena cava itself has been closed, although the only successful case was one in which the sides were brought together by artery forceps and not by suture. The opportunity of end-to-end suture of arteries has rarely offered itself at the front, and as far as the writers know has only been even temporarily successful in one case, that of a bullet wound of the brachial artery; and this vessel gave way and formed an aneurysm some three weeks later. In a few cases the femoral artery has been sutured, but in no case has the operation saved both the limb and the patient.

Although so far the results have been disappointing, this is not a matter for surprise if the condition of the wounded vessels is examined. The class of case in which it was hoped to try this method at the front was that of open wounds such as are generally caused by shell; but unfortunately the ends of the artery are commonly so far apart that it is found that they cannot be brought into apposition after the necessary dissection of the vessel has been done. Even in the popliteal space, where some approximation of the arterial ends can be obtained by flexion of the knee, no case has yet occurred in which arteriorrhaphy has seemed feasible, while small wounds of the limbs or neck with an arterial haematoma seem hardly suitable for this method of treatment.

It was under these circumstances that "Tuffier's tubes" offered some hope of saving limbs from gangrene when arterial suture was out of the question. They have been employed at the front on many occasions, and are, it is believed, well worth trying, as, although they become blocked within about twenty-four hours, they have appeared to tide a limb over this the most critical period before the establishment of the collateral circulation. In one case it was noticed that the tube itself remained unblocked although the artery below became obstructed by clot, and it may be that this distal clotting in the artery will always be a difficulty in practical as opposed to experimental surgery. It must be remembered that in actual practice the limb below the lesion has been deprived of blood for some time before the opportunity occurs of inserting a tube and re-establishing the circulation, and it may be that this period of starvation produces changes in the vessel walls that favour clotting.

There is another observation which may have a bearing on this subject. In civil practice, after the interruption of the main blood supply of a limb and the consequent occurrence of gangrene in its lower part, one looks for and sees the formation of a definite line of demarcation. But in the present campaign it has been found that after the destruction and ligation of an artery this line of demarcation fails to appear in the majority of cases, and the seat of the amputation has to be chosen by noting the place where the limb becomes cold and discoloured, on the one hand, and, on the other, where the capillary circulation is still active, as shown by the return of the skin blush after pressure. No doubt the primary loss of blood has something to do with the frequency of gangrene in the first place, and in the second it would appear that the nature of the injury so upsets the blood supply of the limb that the collateral circulation is slow in being re-established, and that sufficient blood does not reach the part to bring about the rapid and healthy reaction that is necessary for the formation of a distinct line of demarcation.

It is a fact at once curious and important that the arrest of the blood current at a point that is considered a favourable one for the application of a ligature in civil practice is often followed by gangrene when that arrest is caused by a gunshot wound. It may be that the laceration of muscle that so often accompanies such injury is the cause to a certain extent, but there must be other factors at work, as gangrene may follow even a small perforating wound. Wounds of certain arteries stand out as especially dangerous to the vitality of the limb, notably those of the popliteal and the anterior and posterior tibials.

INJURIES OF JOINTS.

A great change for the better has taken place in the results obtained in the treatment of wounded joints.

Experience was chiefly gained on the knee-joint, for it is the joint most frequently hit, most easy of inspection, and its infection is followed by disastrous consequences more often than in the case of other articulations.

In the early days two lines of treatment were followed. The small perforating wounds were left alone and allowed to heal, the progress of the joint being tested by aspirations if necessary. The larger wounds with escape of synovia or actual laying open of the synovial sac were drained, and at first the drains were often introduced into the joint cavity. The results of this treatment were undeniably bad, and all sorts of heroic measures were adopted for the arrest of the septic processes which ensued. But continuous irrigation or an acute flexion of a widely opened articulation gave equally poor results, and the patient was lucky if he escaped with a stiff leg.

The first improvement was the abandonment of the intra-articular drains. The next was the excision of the wound, the removal of any foreign body, the flushing of the joint, and in some cases the closure of the capsule and the insertion of a superficial drain. Closure was especially advocated by Colonel Gray in the year 1915.

The next step was perhaps a bold one. As soon as possible after the receipt of the injury—that is, in the casualty clearing station—the wound was excised, the joint opened, cleaned, and irrigated, and then the whole wound in the synovial sac and the superficial tissues was tightly closed. It was certainly astonishing how seldom infection followed such treatment, even when fragments of shell or pieces of clothing had been removed from the joint; but for its success it is essential that the incisions around the wound edges should be carried quite clear of all infected tissue, and that the strictest asepsis is assured.

Now, every knee-joint with such a wound is given the chance of healing by first intention, although the closure of the joint defect may entail the performance of a plastic operation to provide an adequate cover with a flap of synovial membrane or skin. Even if some infection does follow the closure of the joint, it is well not to be in too great hurry to lay the articulation open, for a certain number of such joints do settle down and provide a better limb than if submitted to more active treatment.

When the joint wound is complicated with fracture of bone it may still be possible in some cases to close it with success. In cases of compound fracture of the patella with loss of substance, partial or complete removal of the fragments, and the provision of a skin flap, will often be followed by primary healing.

When the tibia or femur are involved the case becomes more serious. Of the two fractures that of the tibia is the most to be feared.

In cases of only partial loss of the articular surface of either the tibia or femur, and also in linear oblique fractures of both bones running up into the joint, it is often worth while to try to close the joint and to obtain primary union.

Where there is much comminution of bone, however, and a dirty wound it is better to abandon all hope of saving the joint and perform a limited primary excision. After such an operation the joint surfaces are usually kept apart by extension on a suitable splint, and Carrel's treatment adopted until the wound cleans, when the bone surfaces may be allowed to come into contact.

The knee is the only joint in the body in which penetration of the synovial sac is at all commonly seen without damage to the bony constituents of the articulation. It is therefore not common to have the opportunity of closing other joints, but the opportunity should be taken when it is offered.

More often the surgeon has to treat a greatly disorganized articulation, and in such cases a primary excision is most probably the best course, especially in the case of the shoulder and the elbow.

The primary treatment of wounded joints may be summarized as follows:

1. Fixation on a suitable splint. In the case of the knee this splint should be one of the varieties of the "Thomas" as used for fractured thigh.
2. Beyond this treatment nothing more is required in simple perforating wounds.
3. The taking of an *x*-ray picture in cases where there is a possibility of the retention of a missile or of fracture of the bones.
4. The excision and cleansing of the damaged tissues and the exploration and lavage of the joint.
5. The closure, if possible, of the joint cavity.

HEAD INJURIES.

At the beginning of the war surgeons called upon to treat head injuries applied the ordinary rules of civil practice and operated on them at once. They were confirmed in their opinion that operation was right, since, apart from the mere physical defects, many patients seemed to be suffering from compression.

These operations were done both at casualty clearing stations and field ambulances, but the best method of operative treatment was as yet undeveloped, and the result was that many septic complications were seen at the base. Next, it was noticed at the base that cases which, from force of circumstances, arrived there unoperated upon, did better than those operated on at the front. This was attributed at first to faulty technique, and within limits this criticism was just, as the right operation was as yet undeveloped, both at the base and the front.

The observation was next made that if patients were kept quiet at the place where they were operated upon they did well, while cases operated on and apparently doing well were reported to have arrived in bad condition at the base when evacuated early.

It thus became obvious that there were two reasons for head cases doing badly: (1) The want of a good operation, (2) early evacuation of cases well operated on.

There were then two alternatives: The cases must be either operated on at the front and kept, or else evacuated as soon as possible to the base before operation; a patient must not be operated upon and evacuated forthwith. Two procedures were therefore adopted. In times of pressure head cases were cleaned up and sent to the base at once, provided they were fit to travel, and in quiet times they were operated on and kept at rest at a casualty clearing station for a week or ten days. Even this period of rest after operation proved too short, though the results were better than in earlier evacuation.

The next step was the establishment of special hospitals for head cases at the front. Advantage was taken of the fact that a head case before operation travelled well, and the special hospitals were placed in the back part of an army area. These hospitals were never subjected to the sudden pressure that may fall on an advanced casualty station, and consequently the cases could remain there for a long time. By this means patients experienced the advantages both of early operation and prolonged rest. The actual method of evacuation is as follows: The patients are brought from the trenches to the casualty clearing station as rapidly as possible. Here they are examined and dressed. If the pulse is slow they are sent on to the special hospital. If the pulse is rapid they are put to bed and evacuated later, should they improve. No special attention is paid to the type of wound—reliance is placed on the slow pulse as a sign that the patient will bear the journey.

The type of operation that has eventually been found most beneficial has been arrived at after many changes. Workers, comparatively far apart and not in direct communication, have evolved very much the same operation. At the front a small conservative operation was formerly practised which experience has shown to have been a little too limited in scope. At the base there were two schools—one favoured an extensive removal of bone and a scalp flap, the other an enlargement of the scalp wound and a limited removal of bone. Gradually the types of operations have approximated. It has been found that the removal of bone sufficient to expose half an inch square (1.27 cm.) of uninjured dura is best suited to most cases. Opinions still differ, perhaps, as to the comparative merits of making a flap or enlarging the scalp wound. On the whole, the flap is the best as a routine, unless the wound, as in the case of a horizontal one, is so situated as to compel the use of a very large one.

The recognition of the fact that a slow pulse is not necessarily a symptom of compression (for it may occur with a wide exposure of the brain), and that the symptoms, paralytic and otherwise, are not due to depression of fragments but to a destruction or commotion of the brain matter which is not remediable by operation, has also had an effect upon procedure. In the first place, a slow pulse is welcomed as a sign that recovery may follow, and it is not taken as a sign that operation is urgently needed, but rather that it is worth doing. The recognition that depression of fragments is not the usual cause of the symptoms has also done away with the notion that their removal must be immediately undertaken.

It is true that the sooner a dirty wound is cleaned up the better, but immediate operation is in many head cases followed by a great drop in blood pressure, so that some delay may be actually beneficial on this account, and Colonel Sargent has pointed out that for at least twenty-four hours after injury the brain is liable to be oedematous, and to extrude unduly if operated on while in this condition. A moderate delay has also been said to do good in that it allows adhesions to form between the dura and the pia mater, thus lessening the chance of a spread of infection over the brain surface.

At the same time that the best type of operation as regards the scalp and bony defect was being evolved many other points were in the process of settlement.

1. Excision of the wound was soon decided on.
2. There was at first considerable discussion as to how far the brain should be explored for bone fragments on the one hand and the projectile on the other. Every one was agreed that an *x*-ray picture had become a necessity, and the opinion was gradually formed that a limited and intelligent search for bony fragments and other foreign bodies was beneficial, but that attempts to reach a missile which was deeply embedded in the brain was not justifiable. Results seem to have proved the correctness of this line of treatment, for fragments of shell are reported to have caused little trouble provided their weight was not enough to cause pressure on the surrounding brain during movements of the patient.
3. The fact that many patients with head wounds suffered from septic complications, and the general demand for the drainage of all wounds, led at first to the employment of drainage in most cases of cranial surgery, not only of the scalp but of the brain also. The results of drainage of the brain were not satisfactory, and gradually it was abandoned, at any rate as a primary measure. The introduction of tubes was first omitted, and subsequently, systematic attempts were made to cover in the exposed brain, the scalp being brought together over the defect in the bone and dura, either by simple suture, pericranial flaps, or relieving incisions formed by undercutting the scalp. A drain introduced under the scalp is still generally

employed. This covering up of the brain seems to have been a decided success, and, although septic complications are still too often met with, they are less frequent than in former times. There has consequently been a great decrease in the number of cases of hernia cerebri.

4. There is still some difference of opinion as to whether small cranial depressions and linear fractures with slight inequality of surface, uncomplicated by symptoms, should be operated on in the first instance.

5. Most surgeons have accepted the recommendation of Sargent and Gordon Holmes that depressed fractures over the longitudinal sinuses should be left alone in the first instance.

6. Most operators are of the opinion that the dura mater should not be opened if found intact. The recognition that true compression of the brain is seldom seen has helped the formation of this opinion.

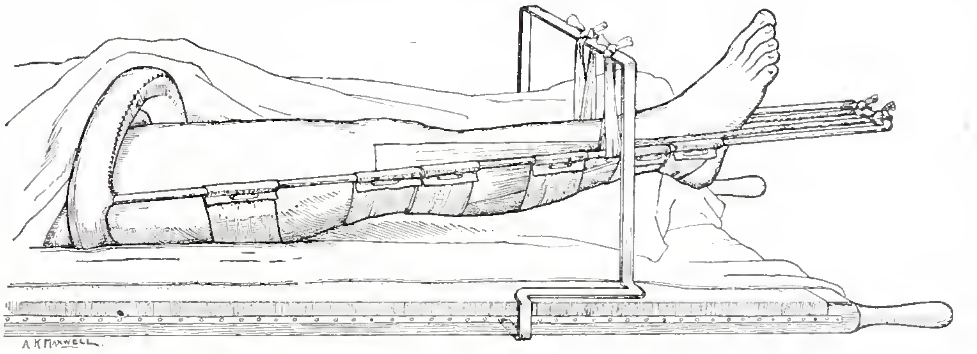
7. A general anaesthetic may with advantage be replaced by the local use of novocain and adrenalin. If this method is adopted the patient is given either hyoscine and morphine or omnopon and scopolamine an hour before the operation.

Thus, by careful individual observation, and by the comparison of results, a method of treatment has been evolved which is applicable to all cranial wounds, and capable of modification in individual cases. It may be summarized as follows:

A primary cleansing of the wound. The transmission of the patient as soon as possible to the hospital where he will convalesce. The taking of *x*-ray pictures. The excision of the scalp and bone wound. A limited and careful removal of foreign bodies. The covering of the exposed brain. The closure of the wound, with superficial drainage, and a prolonged rest in bed.

FRACTURES.

The tendency throughout the war has been to abandon all constricting splints and to trust to extension for fixation of fragments. In the first place, a bandage round a limb, which might from swelling or movement cause constriction, was found to favour the onset of gas gangrene, and in the second, the various forms of Thomas's splint, in which the limb lies on a cradle, gained more and more reputation as a means of efficient splintage. Few other splints are now used on the lower extremity. It is curious that while plaster splints, both as emergency contrivances and as a means of permanent fixation, have steadily increased in use in the French army, in our own they have as steadily fallen into disuse.



Fractured femur, with Thomas's splint and stretcher suspension bar.

The treatment of a compound fracture must be divided into two parts: (*a*) The cleansing of the wound; (*b*) the setting or reduction of the fracture, followed by its maintenance in good position. In the early stages the first is by far the most important, and on its attainment depends, within limits, the success of the second.

Total immediate reduction is good and to be aimed at, provided it can be carried out without prejudice to the cleansing of the wound, but an incomplete reduction, or even no reduction at all, may be advantageous by aiding the disinfection of the wound. Surgeons working at the front are therefore mainly concerned with the primary cleaning of the wound and with the means to transport a patient to the base with comfort and without detriment to the wounded limb.

The organisms that infect a compound fracture may be roughly divided into two classes: (*a*) Anaërobic or gas gangrene producing infection; (*b*) infection due to pus-producing organisms.

Anaërobic or gas gangrene producing infection affects, chiefly the muscles, is sudden in onset and development, but tends to die out if not fatal in the early stages.

Infection by pus-producing organisms affects all the structures of a limb, is generally of slower development, and fatal at a considerably later period. The first (*a*) is the chief cause of death at the front, the second (*b*) of death at the base.

From the fact that it affects muscles, the first is more amenable to treatment by mechanical means—the excision of the affected part or part likely to be infected; but the second, giving little indication of its presence, cannot be so easily removed by such means.

At the beginning of the war fractures were treated very much as they were in South Africa. It is true that fragments of projectiles and clothing were removed, but more attention was paid to the solution of continuity of the bones than to the cleansing of the wound.

The occurrence of gas gangrene quickly called for a remedy, which was found in amputation or incisions into the limb. Then came the demand from the base for free drainage. At first small tubes were used; as these proved inefficacious, large tubes were substituted. At the same time came a more systematic search for foreign bodies. This produced an improvement, and it was reported that the cases that came down with adequate drainage, especially those with dependent drainage, stood a far better chance than those in whom such measures were not taken.

About this time attention was drawn to the fact that many flesh wounds, if freely excised, could be sutured with success. The application of this principle, though it could not be applied *in toto* to fractures, led to more extensive opening up and to better mechanical cleaning by the excision of all dead tissue and the more efficient removal of foreign bodies. These measures greatly reduced the occurrence of gas gangrene and produced an improvement in the suppurative infections. At the same time as these improvements were taking place in operative technique the adoption of the Thomas splint for the lower extremity in one of its many forms was steadily working its own good. The stretcher in the ambulance car and the cot in the train presented a difficulty—there was nothing on which to rest the splint. This difficulty was overcome by two methods. (1) A form of Thomas's splint (devised by Captain Max Page) provided with an attached foot-piece or prop was used so that the splint was raised off the stretcher and the limb lay slung, as it should, in the splint. (2) Two forms of iron bracket (devised respectively by Lieutenant-Colonel Frankau and Captain Richards), attached to the foot of the stretcher, allowed the Thomas splint to be suspended above the canvas of the stretcher.

Patients thus travelled easily in the motor ambulances, and the difficulty of the cot in the train was easily surmounted by sending the patient down on the stretcher. This latter expedient has been of great benefit to the wounded, as once placed on his stretcher at the casualty clearing station he can remain undisturbed until he reaches his bed at the base.

The fixation in a Thomas splint depends upon the extension. An efficient extension is therefore of prime importance. Sinclair's glue has provided the means. It is easily and quickly applied, and has the additional advantage that it produces no constriction of the limb. It has another advantage, it can be used when only a short portion of the leg is available, a very great gain when dealing with limbs covered with multiple wounds.

There are, of course, a few fractures of the femur that cannot be treated with Thomas's splint—namely, those in which a wound has been received on the part covered by the ring. For these the old Liston splint is used, or in some cases the abduction frame of Jones, though the bulk of the latter makes it unsuitable for work at the front.

Below the knee the Thomas splint can nearly always be used, except in those cases in which the fracture is near the ankle. Even here it is often possible to use it by the aid of the sole extension as devised by Sinclair.

In the case of fractures of the upper extremity the Thomas splint has not proved so satisfactory, but only for the reason that the straight posture of the arm is unsuited to transport except under special circumstances, as in transit by barge. The form of Thomas splint for the bent arm has not proved a success. For transport the form of internal angular splint, with a hinged back piece for the upper arm as devised by Captain Colin Clarke, is probably the best.

The development of the operative side of the casualty clearing station and the provision of *x* rays has been of inestimable benefit to the patient. There can be no doubt that the chance of the patient recovering with a good limb and of escaping a long period of suppuration depends on the attention that can be paid to his wound in the first instance. No amount of after-care can ever make up for the want of it at the first moment. A thorough and deliberate operation is all-important. There must be a free opening; the cavity must be explored by the eye, and not only by the finger, otherwise dead tissue and possibly foreign bodies will be passed over.

When first received, the wound is dirty, but the number of pus-producing bacteria is comparatively few. In a few days it is probable, no matter what treatment is adopted, that they will have greatly increased in number. If the first operation has been incomplete, a second may be necessary at the very time that the wound is in the worst possible state, and the procedure necessary to supplement the primary operation may be disastrous in exposing fascial planes to infection from a wound teeming with bacteria.

The early, deliberate and efficient cleansing of the wound is the basis of success, no matter what chemicals are used after it is completed.

Reference.
British Medical Journal, August 7th, 1915.

PENETRATING WOUNDS OF THE CHEST AT THE CASUALTY CLEARING STATIONS.

BY

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The number of chest wounds admitted to the clearing stations is about 2 per cent. of the whole number of wounds admitted. The most favourable cases are those in which a bullet has gone right through the chest; the least favourable, those made by a piece of shell which is retained within the chest.

In cases where the missile has involved both the chest and the abdomen the prognosis is very unfavourable. Occasionally the whole stomach, or part of the intestine, is drawn up into the pleura through a wound of the diaphragm. In other cases the abdominal viscera are so injured as to prevent recovery. In any case the addition of a wound of these organs to the temporary loss of the use of one lung, which is the usual result of a wound of the chest, produces a condition from which very few recover. Injury to the spinal cord is a still more fatal complication.

The following notes are chiefly drawn from a consecutive series of 211 cases, of which careful observations were made and recorded at the time.

The patients are often much collapsed at time of admission, so that in many cases the heart cannot be felt, and in some cannot even be heard for the first twenty-four hours. With warmth, rest, and morphine, they improve greatly by the second day.

Few cases bleed dangerously from the external wound. When this occurs, it can usually be stopped by plugging the wound. There is often much distress if the external wound admits the free entry and exit of air in respiration. It is almost at once relieved if the wound be made air-tight with strapping over the dressing. For these large openings into the pleura, in which sometimes three or four ribs are smashed, and infection from the open air would be almost inevitable, a form of procedure has recently been adopted which promises well. After careful paring of the wound, removal of loose bone, and blunting of sharp edges, the skin and, where possible, the muscles are drawn together and stitched over the aperture, leaving either only a small hole for a drainage tube or none. If a tube is left in, the cavity is then filled with an antiseptic. One surgeon is using emerald green, 1 part to 1,000 of solution of gum tragacanth, for this purpose.

In all but fourteen of the series there were signs of haemothorax. It is rare for the effusion to increase in extent under observation. The chief safeguard against continued haemorrhage is collapse of the lung. In one case which died from repeated external haemorrhage the lung was found adherent to the pleura throughout. Collapse had not in consequence taken place. In another (not in this series) that died with an increase of the haemothorax, by repeated internal haemorrhage, a piece of metal was found lodged in a large pulmonary vessel which it had partially but not completely severed. The retraction of the vessel was thus prevented.

When the effusion is moderate in size, reaching not above the middle of the scapula, nor further forward than the mid-axillary line, it does not cause serious distress. These cases form the great majority. In them by the third day the pulse falls to 84, the respirations to 28, and the temperature will be falling also. Since the observations of Bradford have shown that fresh haemorrhage hardly ever occurs after the lapse of seventy-two hours from the wound, such cases were, as a rule, evacuated at the end of that time. Information from the base showed that this policy was not attended by any bad results.

When the effusion is greater than this, specially if it is complicated by pneumothorax, the patient usually shows distress. The heart is displaced, the pulse is above 100 and the respiration is over 32. Such cases are not fit to travel. They should be aspirated, and about a pint of blood and as much air as possible should be withdrawn. Some were rendered comfortable by this procedure and were able to travel without damage on the fourth or fifth day. It must be noted that the hospital was close to the train, and that though the journey might last even to thirty hours the conditions were comfortable.

It was not thought desirable at so early a stage to remove the fluid completely with the aid of oxygen replacement; that procedure was therefore left for the base hospitals.

In the latter part of the year 1916 a new method of treatment was adopted in a limited number of cases, especially in patients in whom a missile was found by *x* rays to be retained in the chest. On the second day after the injury, ribs were resected or a costal flap turned back, the pleura opened, and the missile removed. The pleura was then thoroughly washed out, and the whole wound carefully closed. The number of cases so treated is as yet insufficient to enable definite conclusions to be drawn, but experience is so far favourable.

The complications, other than mere size of the haemothorax, which prevented early evacuation, were either septic infection of the effusion on the wounded side, or some disease of the lung on the opposite or unwounded side. In many cases a missile rakes the chest and enters both pleurae. Neither lung can then be called unwounded. The term is confined to cases where one pleura alone has been injured. These complications will now be considered.

In some cases the patient may be comfortable while at rest and have no fever, but on examination there may be the signs of consolidation of the unwounded lung, and movement may produce shortness of breath and some cyanosis. In such cases the condition is that of massive collapse of part, usually at the base, of the unwounded lung. The side is often contracted, the heart is drawn over, and the *x* rays, if available, show the diaphragm raised and motionless. This condition, familiar after abdominal operations in civil life, was found by Bradford to be a frequent complication of chest wounds. It clears up in about a week.

In other cases there may be an increasing cyanosis and distress, even at rest, for which the condition of the wounded side does not account. On the unwounded side there may be the signs of bronchopneumonia. Some of these are true cases of that disease. But more of them are due to engorgement of the unwounded lung which affects the back and the lower lobe chiefly. The whole of the affected part is solid with blood, and on section presents a glistening surface of dark crimson colour. Its causation is not clear, but the situation argues failure of the pulmonary circulation.

Unquestionably, however, if the cases be followed through, the most common complication of chest wounds is infection of the haemothorax. When cases are sent down on the fourth day not many infected cases are seen at the clearing station. It is, however, important that the medical officer should be quick to mark its symptoms. The face is pale, though there may be a local flush, the expression anxious, the tongue dry, the appetite bad, and there may be vomiting. The pulse and respiration usually quicken and the temperature rises. In many cases gas formation within the thorax is shown by the alteration of the physical signs and the displacement of the heart. But this does not always occur, nor are any of the other symptoms constant.

Briefly speaking, whenever the medical officer is dissatisfied with the progress of the patient and cannot otherwise explain it, he should always suspect septic infection. If suspicion is aroused, aspiration should be performed at once. Sometimes the fluid will be found to stink, or it may be seen to contain pus, or the froth may remain permanently crimson from haemolysis. Any of these signs is sufficient to indicate that a free opening should immediately be made. If doubt remains, it is well, after drawing off a pint of the effusion, to leave the patient for a day, and, unless he has by then obviously improved, to operate. Bacteriological evidence, when forthcoming, is valuable as a confirmation, but it is on the one hand uncertain, for the infection may be confined to a certain part only of the pleura, and on the other, may cause considerable delay. Clinical evidence should always be trusted, and action taken upon it without hesitation.

Five cases of septic infection occurred before the fifth day after the wound in the present series of cases. In all a free opening was made at the clearing station, and all these patients, though some of them were very ill for a time, recovered sufficiently to be evacuated.

In the whole series there were twenty-two deaths, of which two were due to wounds of the heart, ten to conditions of the pleura and lungs, and ten to wounds of the spine or abdomen. The remainder were evacuated.

THE ADMINISTRATION OF ANAESTHETICS AT THE FRONT.

BY

CAPTAIN GEOFFREY MARSHALL, R.A.M.C.(S.R.).

FROM the point of view of the anaesthetist, wounded men may be divided into three main classes:

1. The lightly wounded.
2. Those suffering from serious wounds with more or less shock and haemorrhage, the two factors being commonly associated.
3. Those suffering from a severe degree of sepsis, especially anaërobic infection.

The choice of anaesthetic depends on which of these classes the patient belongs to, as well as on the region of the body injured.

1. THE LIGHTLY WOUNDED.

These patients are good subjects for anaesthesia, so that the chief desiderata are safety, speed, and convenience. The ideal anaesthetic is one with which induction is rapid, and recovery complete a few minutes after operation, so that the patient is in fit condition for early evacuation by ambulance train.

Gas and oxygen anaesthesia meets these requirements best. With its help a greater number of these cases can be dealt with satisfactorily in a limited time than with any other anaesthetic. When this method is not available, ether should be used. The ether is best administered as a warm vapour by "Shipway's apparatus," as both induction and recovery are more rapid than with the open method.

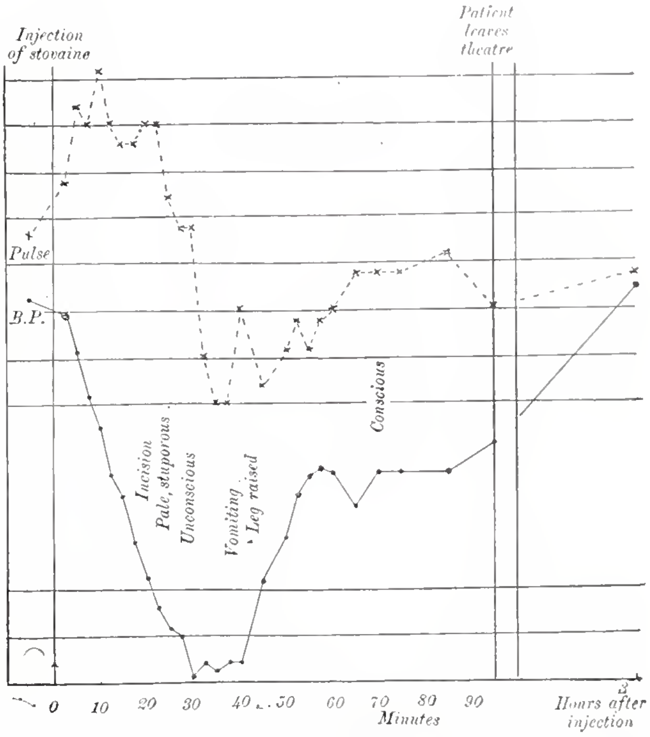
Local anaesthesia can only be employed in a small number of cases, on account of the multiplicity of wounds and their lacerated and soiled condition.

II. THE SERIOUSLY WOUNDED.

In the more serious cases the one consideration is safety. In other words, we require an anaesthetic which will not be harmful to a patient who is still suffering from the shock of injury, and one which will minimize the shock of operation.

Spinal Anaesthesia.

It has been urged that spinal anaesthesia would meet these requirements, especially in wounds of the legs and thighs, and would therefore be of great value in military surgery. In practice, however, it is found that the intrathecal administration of stovaine has dangers of its own when applied to men whose wounds are recent. In a large proportion of these cases the administration is followed by a great fall of blood pressure and symptoms of cerebral anaemia, that is, pallor, vomiting, loss of consciousness, and occasionally convulsions. The syncope is sometimes fatal. It is in the man who has lost blood, and whose wounds are less than forty hours old, that spinal anaesthesia is dangerous. This is shown by an analysis of fifty consecutive cases operated on at a clearing station under stovaine spinal anaesthesia.



In the charts the continuous line represents blood pressure in millimetres of mercury. The dotted line represents pulse rate per minute.

CHART I.—Spinal anaesthesia. Group A. Stovaine 0.075 gram. Wounds of leg and buttock twenty-one hours. Haemoglobin 85 per cent. Operation conservative. Death twenty-four hours later from gas gangrene.

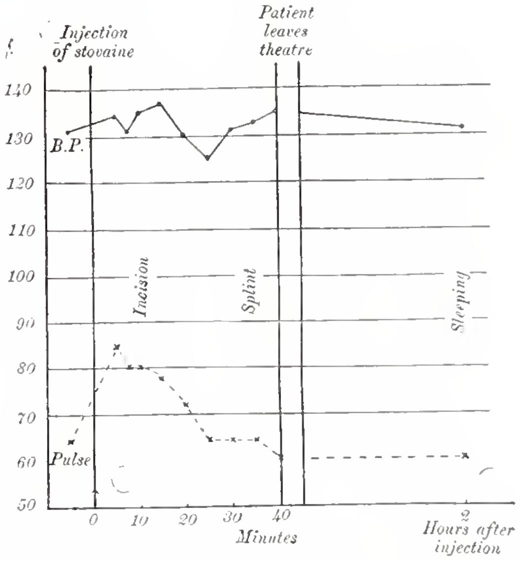


CHART II.—Spinal anaesthesia. Group B. Stovaine 0.1 gram with glucose. Wounds of thigh sixteen hours. Haemoglobin 102 per cent. Operation conservative. Recovered.

All the patients had wounds of the lower extremities. In each case the percentage of haemoglobin in the patient's blood was estimated before operation; a low percentage of haemoglobin in a man whose wounds are recent may be taken to indicate that the patient has bled. The fifty cases fall into three groups:

Group A.—Men operated on within forty hours of receiving their wounds, and whose blood was dilute (indicating haemorrhage).

Group B.—Men operated on within forty hours of receiving their wounds, whose blood was *not* dilute.

Group C.—All cases in which a greater interval than forty hours had elapsed between wounding and operation.

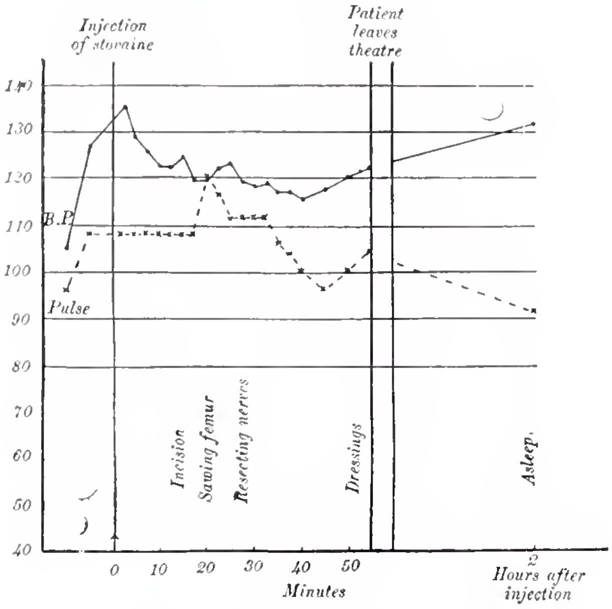


CHART III.—Spinal anaesthesia. Group C Stovaine 0.1 gram with glucose. Wound of thigh and femoral artery twenty-three days. Haemoglobin 45 per cent. Gangrene of leg. Amputation lower third thigh. Recovered.

In Group A there were twenty-two cases. Of these, nineteen showed symptoms of collapse after injection of the anaesthetic. The average fall of blood pressure was 57 mm. of mercury; in only three cases was the fall of pressure less than 35 mm., the greatest fall was 99 mm.

In Group B there were sixteen cases. Of these, only three developed any untoward symptoms after injection, and these were trivial—in one case nausea and in the other two pallor only. The average fall of blood pressure was 17 mm., the greatest 33 mm.

In Group C there were six cases. None showed any symptoms of collapse. The average fall of blood pressure was 19.7 mm. and the greatest 35 mm.

For the prevention or combating of the collapse the most important factor was found to be the position of the patient; the symptoms are alleviated by raising the legs and lowering the head. It is safe to lower the head fifteen minutes after injection. Neither strychnine nor pituitrin were of any use in combating the collapse, nor did preliminary injection of strychnine prevent it. The dose of stovaine given varied from 0.05 to 0.1 gram, and within these limits the fall of blood pressure was not proportional to the dose of the drug. Some of the greatest falls of pressure were associated with the smallest doses of stovaine and vice versa. With doses smaller than 0.05 gram, the anaesthetic effects were so slow and uncertain as to make the method impracticable at a clearing station.

Wounds of the Limbs Necessitating Amputation.

There are few more unfavourable subjects for anaesthesia than the man who is suffering from the shock of a recently shattered limb, and who has to undergo the further shock of amputation. The mortality of these cases can be greatly reduced if correct procedure be followed.

In the first place, the patient must be put to bed and surrounded with hot bottles or a hot-air bath. However urgent operation may be surgically, it is useless to perform it before the patient has been thoroughly warmed up.

In the second place, morphine should be withheld before operation or given only in small doses.

In the third place, gas and oxygen should be the anaesthetic used for operation. Results are so much better with this mixture that no other anaesthetic is justifiable.

If chloroform be used, the patient's condition will deteriorate during the administration, and he will not rally afterwards. With inhalation ether the condition may improve and the blood pressure rise during operation, but there will be a collapse during the next two hours. With intravenous ether the temporary improvement is more striking and the after-collapse more profound and more often fatal.

Shock.

Shock is a condition which still evades precise definition, although seen so commonly in wounded men. The injuries which cause it are almost invariably severe in themselves, that is, they involve important structures or extensive areas of tissue. In a typical case there is dusky pallor of the face, the radial pulse is flickering or imperceptible, and the surface temperature low. There is repeated vomiting, but the patient shows remarkably little mental disturbance, and may be fully conscious and intelligent within a few minutes of death. The arterial blood pressure is often higher than might be expected from the character of the pulse, and shock is usually profound if associated with a systolic pressure lower than 80 mm. of mercury; we refer to readings taken by means of a Riva-Rocci sphygmomanometer with auscultation over the brachial artery. The blood in the capillaries of the extremities is dark and cyanotic. In cases of shock unassociated with haemorrhage we have found the blood to be more concentrated than normal.

Treatment of Shock before Operation.

We have stated that, however urgent it may be, operation should not be performed on a patient suffering from shock until means have been taken to mitigate this condition.

The one measure which commonly produces definite improvement is the application of external warmth. Excellent results have been obtained by the application of heat from electric light lamps or by the use of an improvised hot-air bath, and if such a patient as we have described be put to bed and treated by these methods, or surrounded with hot bottles, his surface temperature rises, his colour improves, and his arterial blood pressure will as a rule go up steadily for several hours. He will then be much less likely to succumb if subjected to a severe operation.

Fluids are best given either by mouth or rectum. Subcutaneous infusion produces no measurable effect in this type of case; and if death occurs as late as thirty hours after infusion, the bulk of the fluid will still be found in the subcutaneous tissues. The intravenous administration of saline is of little use before operation. It causes a temporary rise of blood pressure and slowing of the pulse rate, but does not render the patient less susceptible to further shock. The blood pressure falls again as soon as operation is begun. Transfusion is best done towards the end of operation; it will then often cause a lasting improvement in the patient's condition. We have found that hypertonic saline produces a more lasting elevation of blood pressure, slowing of the pulse, and dilution of the blood than does the normal solution. Transfusion with blood gives still better results. The use of artificial viscous fluids is still under trial.

The Limitation of Shock during Operation.

The recently injured patient is particularly susceptible to further shock, and this susceptibility is increased by certain drugs used in the production of anaesthesia, for example, chloroform, ether, and morphine in large doses. These drugs should therefore be avoided in dealing with a patient who is suffering from recent wounds and who has to undergo a severe operation such as amputation through the thigh. Chart IV shows the serious fall of blood pressure which occurred an hour after amputation under ether vapour anaesthesia. Charts V and VI illustrate the still greater collapse after intravenous ether. Chart VII shows how trivial is the effect on pulse rate and blood pressure when the operation is done under gas and oxygen.

We have already indicated that amputation is a much less dangerous procedure to a patient who is not already suffering from shock or haemorrhage. Chart III was an example of amputation under spinal anaesthesia, and Chart VIII under intravenous ether, both in cases of severe sepsis but in which the initial shock of injury had passed off. Chloroform is dangerous even in this type of case; Chart IX illustrates a fatal example.

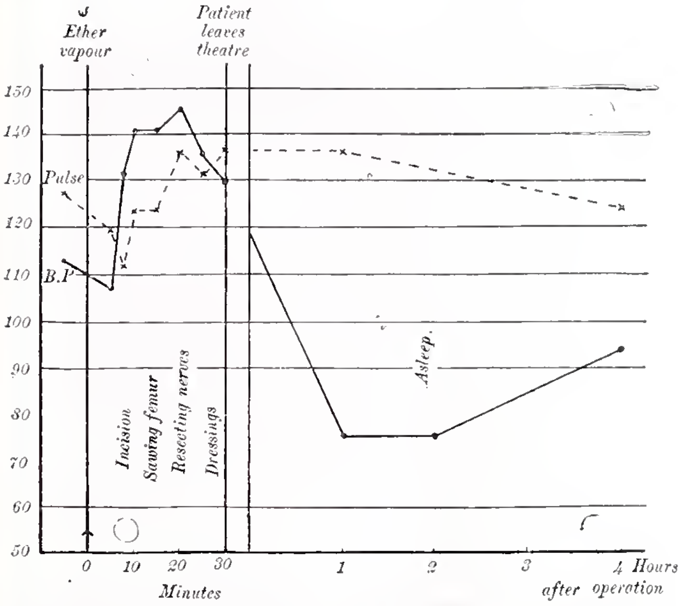


CHART IV.—Anaesthesia by ether vapour. Wound of leg thirty-six hours; tibia shattered. Haemoglobin 62 per cent. Amputation lower third thigh. Recovered.

Wounds of the Head.

Operations on the head may be performed under local anaesthesia. All tissues of the scalp are infiltrated in a circle surrounding the site of operation with a solution of novocain and adrenalin. No pain is felt even when bone and dura are dealt with. On the other hand, the forcible cutting of bone is disturbing to the patient, so that where mentality is unimpaired, hyoscine and morphine should be given an hour before operation. If general anaesthesia is preferred, this may be obtained safely and conveniently with Shipway's apparatus. A warmed mixture of ether and oxygen is administered through a catheter passed down the more patent of the two nostrils.

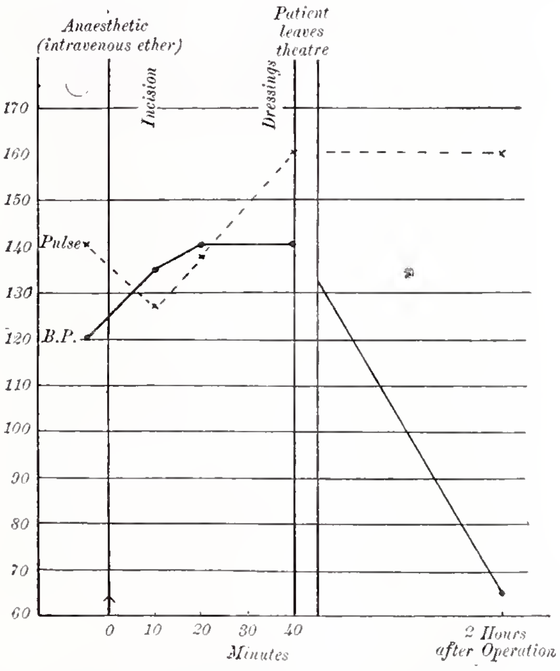


CHART V.—Anaesthesia by intravenous ether. Wound of thigh twenty-two hours; femur fractured. Haemoglobin 84 per cent. Operation conservative. Recovered.

Wounds of the Chest.

Ether should not be administered to a patient with a perforating wound of the chest, as it usually provokes fresh intrathoracic haemorrhage. For small operations, such as the resection of a rib, local anaesthesia should be employed. The intercostal nerves of the rib to be resected and the rib above are blocked by injection of a solution of novocain and adrenalin into the subcostal grooves close to the angles of the ribs. For more extensive operations, requiring general anaesthesia, we give a preliminary injection of morphine gr. $\frac{1}{6}$, hyoscine gr. $\frac{1}{100}$, and atropine gr. $\frac{1}{100}$, and follow this with a minimal amount of warm chloroform vapour with oxygen.

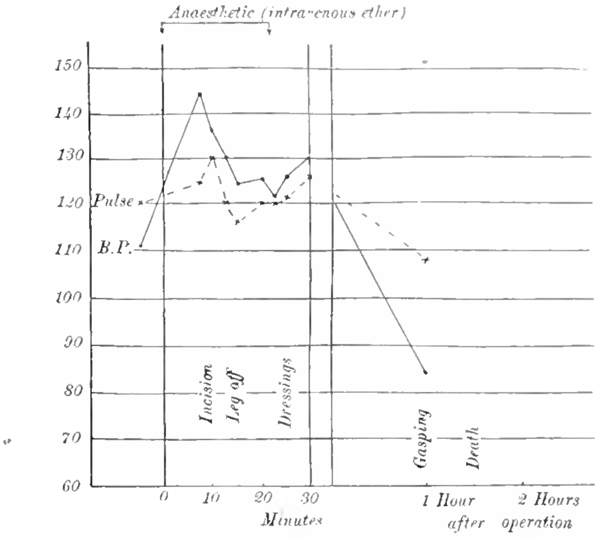


CHART VI.—Anaesthesia by intravenous ether. Wound of leg six days. Secondary haemorrhage seven hours before operation. Amputation mid-thigh; collapse and death eighty minutes after.

Wounds of the Abdomen.

For these cases we have found the most satisfactory anaesthetic to be a warmed mixture of ether vapour and oxygen. Compared with "open ether," we find that the warm vapour gives a more rapid and quiet induction, easier breathing, and diminished heat loss during operation and less vomiting afterwards.

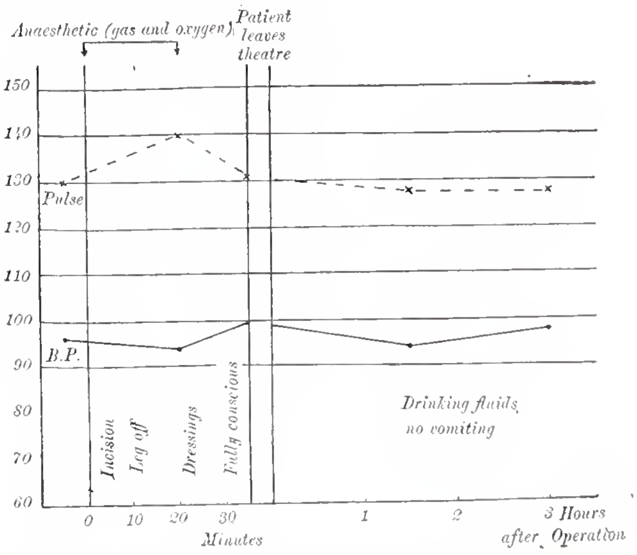


CHART VII.—Anaesthesia by gas and oxygen. Wound of thigh twenty-one hours; femur shattered. Patient pale and vomiting. Haemoglobin 82 per cent. Amputation mid-thigh. Recovered.

Men wounded in the abdomen are especially liable to develop bronchitis, perhaps owing to deficient movement of the lower part of the chest. In a series of these cases anaesthetized with open ether, 54 per cent. developed bronchitis after operation. In a comparable series anaesthetized with warm ether vapour, the percentage of bronchitis was only 14.7.

Blood Pressure during Operations on the Wounded Abdomen.

During the course of an ether vapour anaesthetic the blood pressure shows a tendency to rise, but if there is much manipulation of gut and mesentery, it will gradually fall. The process may be continued for hours without the pressure falling to a dangerous level. Exposure of gut outside the abdominal cavity produces a much more serious effect. If more than two or three feet are exposed, the blood pressure will commence to fall after a few minutes, and will continue to fall rapidly until the gut is replaced. This effect is seen when stomach and omentum are exposed, and even with great omentum alone. The indication is that surgeons should make big incisions, and work as far as possible with the gut lying inside the abdomen. Covering the exposed gut with pads wrung out in hot saline does not prevent the fall of blood pressure.

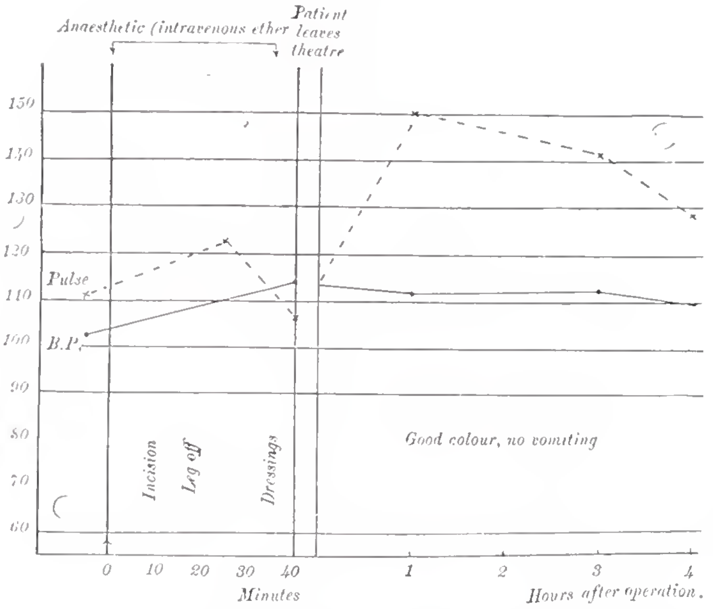


CHART VIII.—Anaesthesia by intravenous ether. Wounds of both thighs fifteen days. Left thigh amputated thirteen days. Severe sepsis, persistent hiccough and vomiting. Amputation lower third right thigh. Recovered.

Exposure of gut produces far less effect if the patient is not under an anaesthetic. We have seen men arrive from the line with several feet of intestine prolapsed through a wound, yet their blood pressure was within normal limits. In one case more than two-thirds of the small gut had been outside the abdominal cavity for at least four hours, and this man's blood pressure was 142 mm. of mercury, and his pulse rate only 108. The patient recovered.

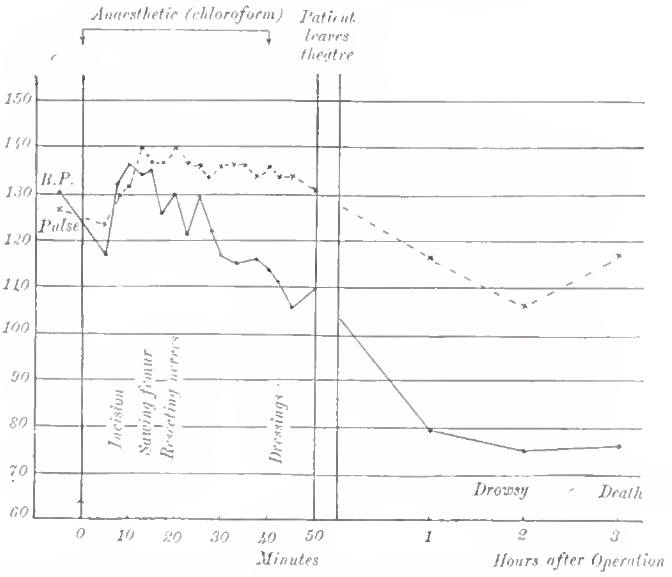


CHART IX.—Anaesthesia by chloroform vapour. Wound of leg seven days. Secondary amputation lower third thigh. Death ten hours after operation.

Apart from copious haemorrhage, there is one other procedure which causes rapid fall of blood pressure in abdominal operations. This is turning the patient on his side. The effect is only seen if the patient has been under the anaesthetic for a considerable time before being turned. At the end of an abdominal operation the patient may be in good condition. He is then turned on the right or left side so that the surgeon may excise a wound in the back. In a few minutes there is a great fall of blood pressure, and the radial pulse disappears. It may be hours before the patient recovers this lost ground. If possible, wounds of the back should be dealt with before laparotomy, as turning the patient has no ill effect during the first half-hour of an ether anaesthesia.

If chloroform be used in these abdominal operations, the blood pressure will fall during administration and for some hours afterwards. This drug is therefore to be avoided except where ether is contraindicated, as in cases in which projectiles have penetrated the chest as well as the abdomen.

The intrathecal administration of stovaine is unsafe, and should not be employed.

III. PATIENTS WITH SEPSIS.

The patient whose condition is rendered grave by sepsis will stand an amputation far better than the man who is suffering from shock. In the septic case, gas and oxygen again gives excellent results, but spinal anaesthesia, warm ether vapour, and intravenous ether are also comparatively safe. Chloroform, however, is to be avoided, as it is often followed by a slow fall of blood pressure which ends in death during the twelve hours succeeding operation.

THE COLOUR CHANGES SEEN IN SKIN AND MUSCLE IN GAS GANGRENE.

[WITH COLOURED PLATES.]

BY

COLONEL CUTHBERT WALLACE, C.M.G., A.M.S.,
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A SHORT time ago[1] I ventured to support Kenneth Taylor's statement that gas gangrene was primarily and mainly a disease of muscle. Further work and observation have only strengthened this belief. It is the object of this paper to describe the naked-eye alterations in the appearances of the skin and muscle in the sequence in which they occur.

Through the kindness of the Medical Research Committee I am able to illustrate some of the changes by the reproduction of coloured drawings made by Sergeant A. K. Maxwell, R.A.M.C. I should like to take the opportunity of congratulating him on the skill he has displayed in catching the delicate tints in the colour changes.

Colour Changes in the Skin.

The changes in the skin of an affected limb may share in the general icteric tint that affects the whole body in some cases. This has been well portrayed elsewhere,[2] and need not detain us here. Coming to the more local lesions, it is first necessary to state that the skin of an affected limb may appear, and usually is, perfectly normal in the early stages; even under a normal skin, however, the disease in the muscles may be so far advanced as to necessitate amputation. The first essential change in the colour of the skin is due simply to the swelling of the limb. At this stage the skin looks somewhat tense, just as it does over any deep-seated swelling, and is paler than normal, owing to the blood being driven out of it by pressure. Resonance to percussion, and even crepitations, may be perceptible at this stage. Simple pallor of the skin is succeeded by a dirty cream tint, which may be taken to indicate that gangrene is certainly established. Up to this stage examination through an incision may reveal only partial or complete involvement of a single muscle, or of a limited group of muscles, so that the condition may be suitable for treatment by local excision.

The subsequent changes in the skin are quicker and more dramatic. Areas of purple staining appear, which enlarge and coalesce. The margins of these are fairly distinct but irregular, and the intervening skin is greyish-white in colour. Soon there appear blebs filled with fluid

GAS GANGRENE

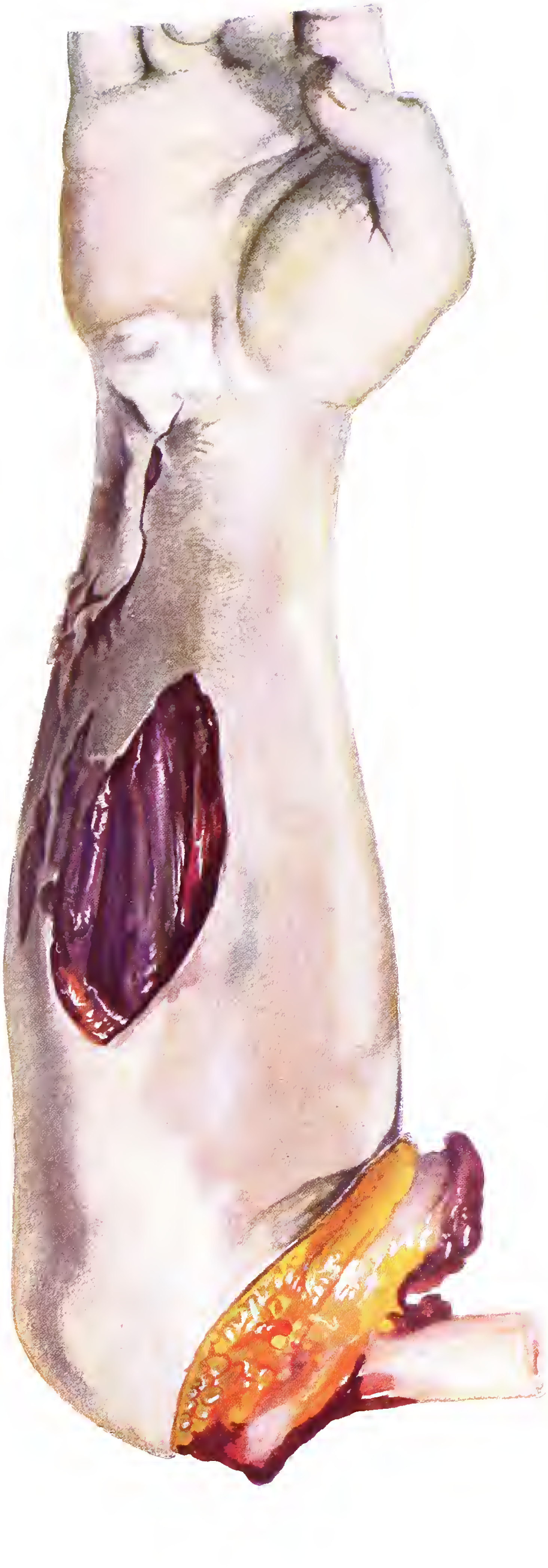

Fig. I.

GAS GANGRENE.

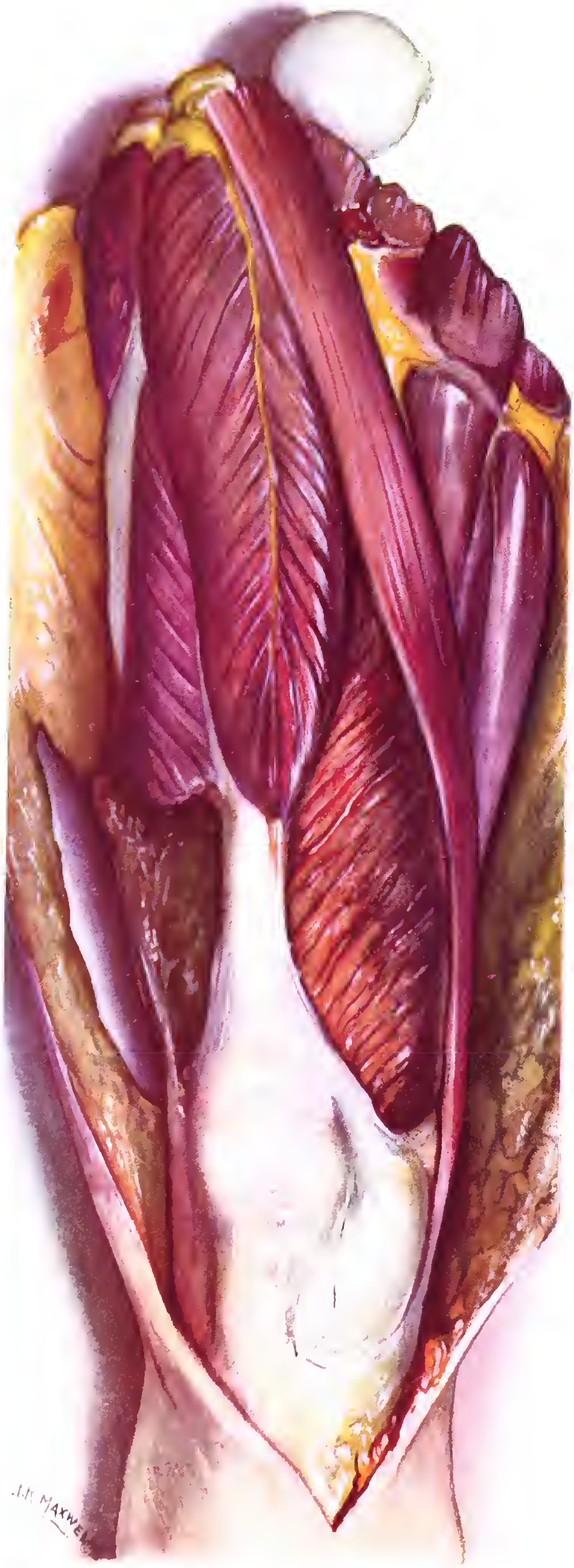

FIG. II

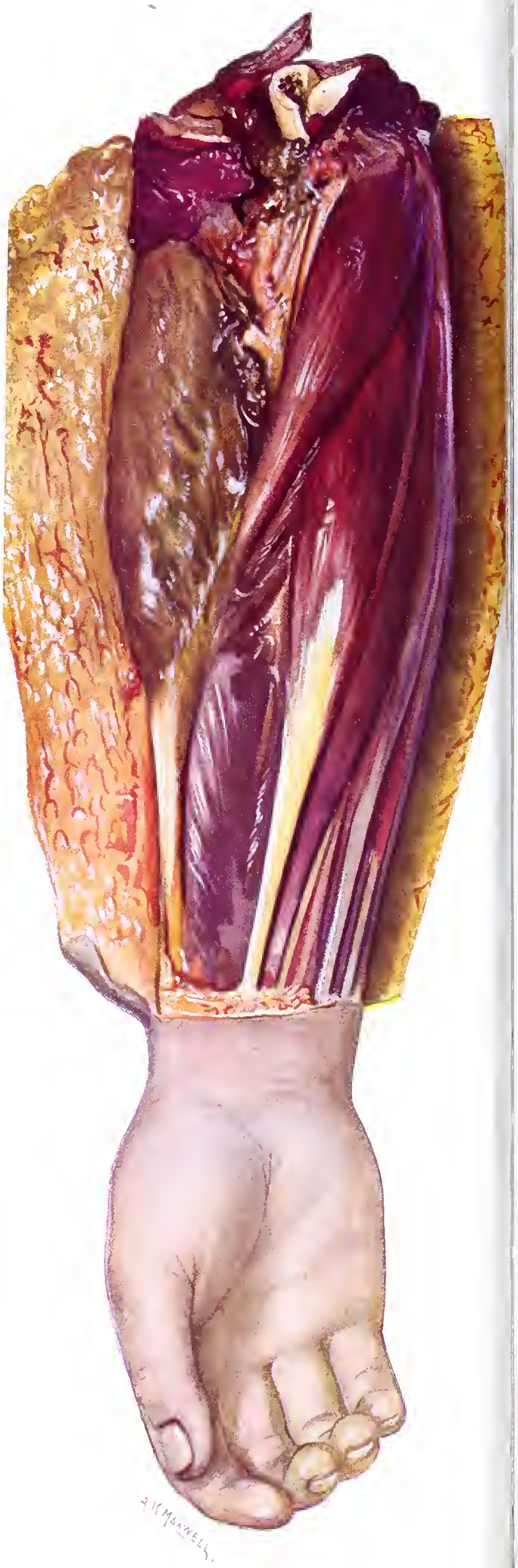

FIG. III

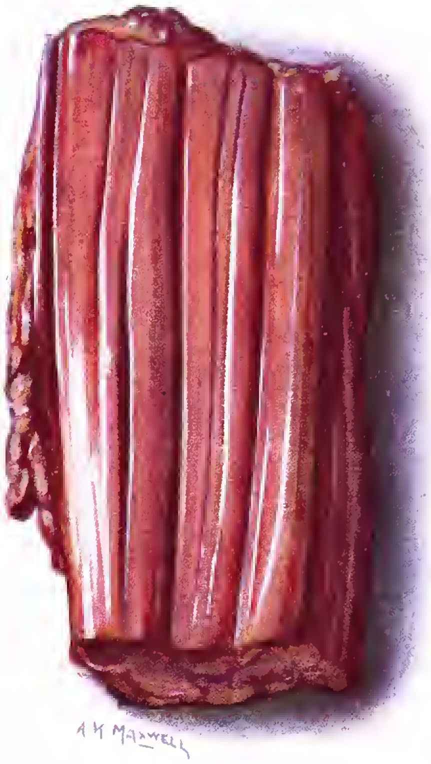

FIG. IV.

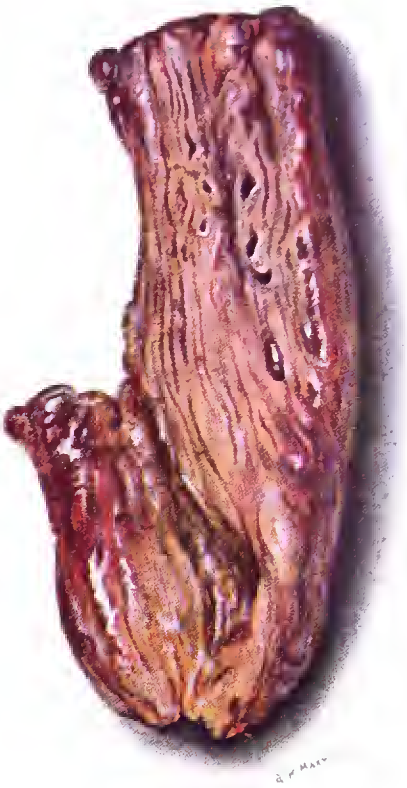

FIG. V.

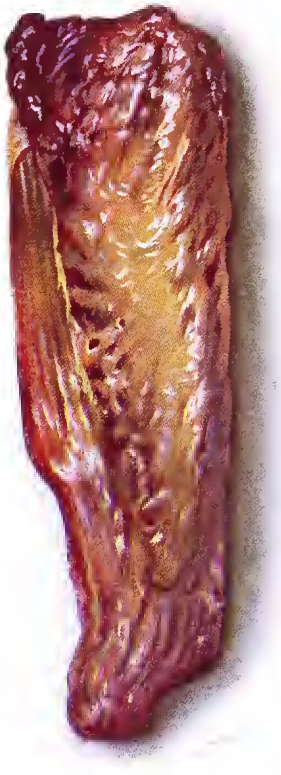

FIG. VI

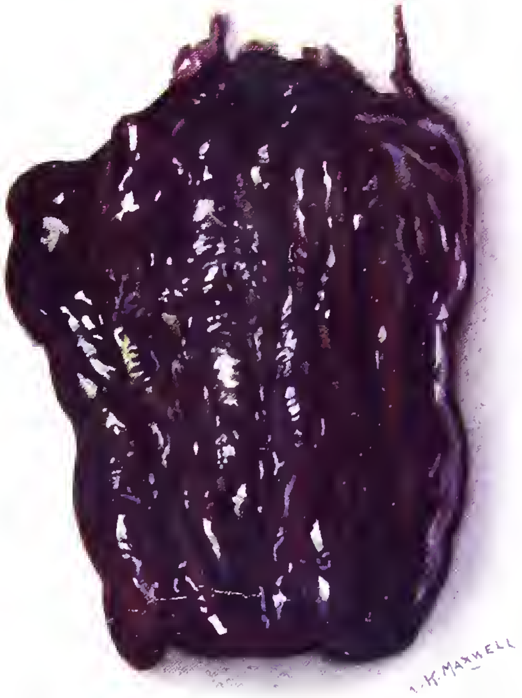

FIG. VII.

GAS GANGRENE.

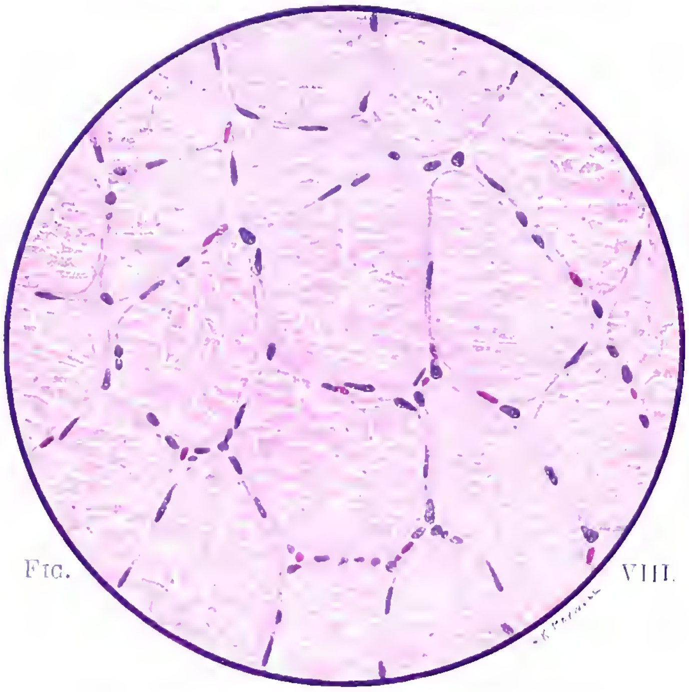

FIG. VIII.

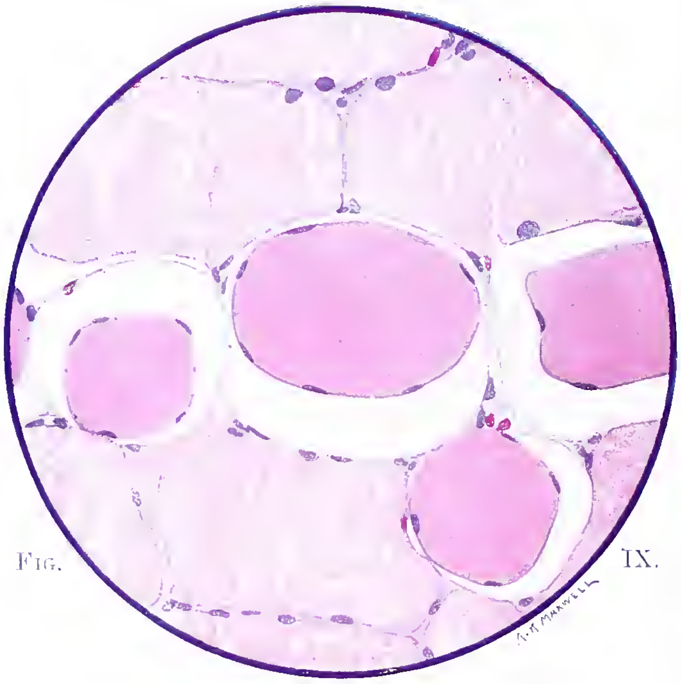

FIG. IX.

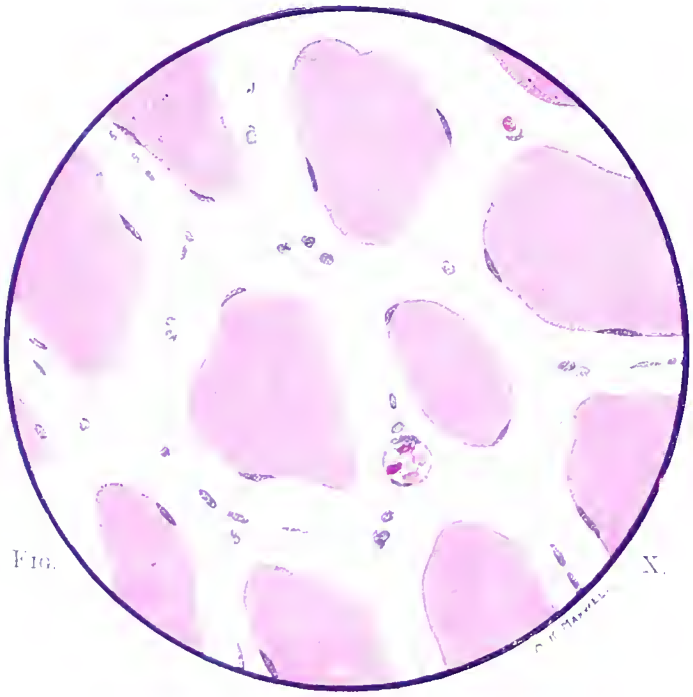

FIG. X.

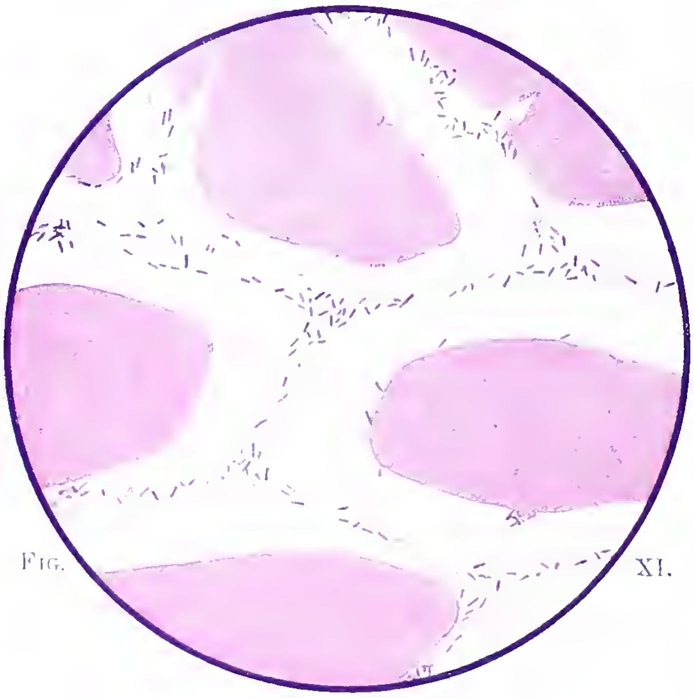

FIG. XI.

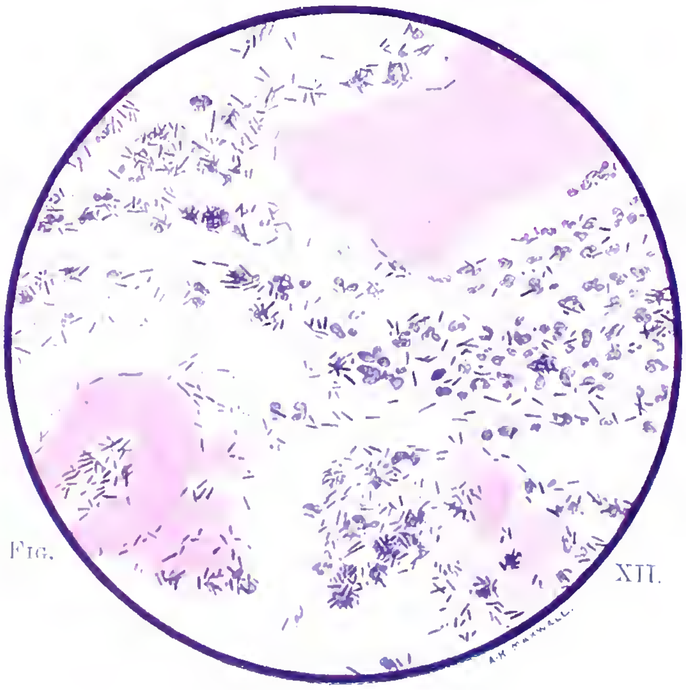

FIG. XII.

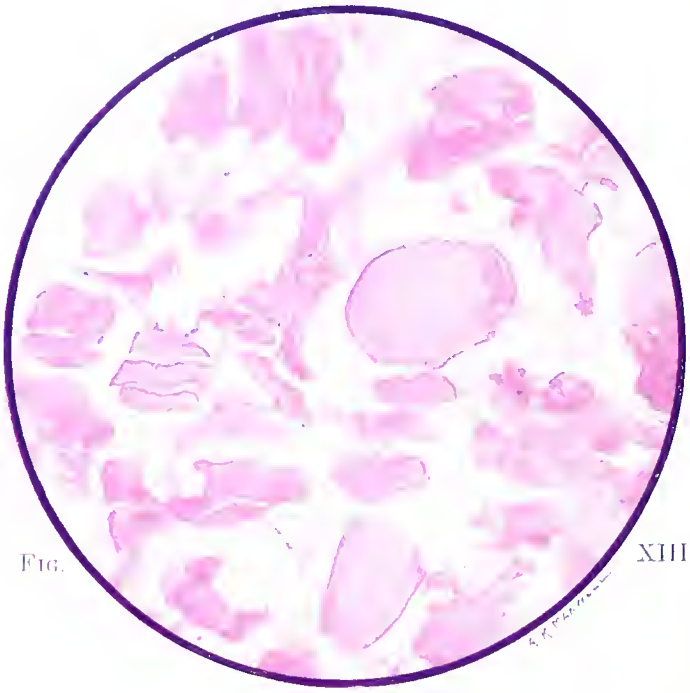

FIG. XIII.

which is stained by altered blood; removal of the cuticle from these exposes a shiny purple-red area of dermis. When this condition of the skin is reached it may safely be inferred that the gangrenous process is so far advanced as to necessitate amputation.

In the last stage to which reference need be made, the purple is succeeded by a dark yellow-green tint. It will be seen that these later changes are identical with what may occur in any limb after death, and are essentially *post-mortem* phenomena due to bacterial action. The late colour changes may be influenced according to the relative parts played by bacterial action on the one hand and by arrest of blood supply on the other. Thus, near an infected wound the yellow-green tint may develop early, whereas in a segment of limb infected only after its blood supply has been cut off, the stage of purple discoloration may still predominate at operation.

Figure I is a drawing made from a forearm which was amputated on account of gas gangrene. The projectile passed across the flexor aspect of the forearm, causing great laceration of the muscles. The whole of the muscles on the flexor aspect were gangrenous, the change being most advanced in the deep flexors and the supinator brevis, which were diffluent. There was in this case ample opportunity for direct infection of the different muscles. The main arteries were intact, so that the gangrenous process was entirely due to infection; in other words, it was not a case of infection after arterial death, but of infection producing total destruction of the muscles and consequently of the skin and subcutaneous tissues. The drawing speaks for itself and requires but little explanation. It shows the purple mottling of the skin, and the contrast between the infected flexor muscles seen through the wound and the normal-coloured muscle by the side of the cut humerus.

There is another change in the skin — namely, "bronzing," to which allusion must be made because it has attracted considerable notice. It is regretted that no example of this could be obtained while the artist was present, but a coloured drawing of the condition has been published elsewhere.[3] The plate was merely described as "multiple shell wounds," but the bronzed area can be well seen over the hollow part of the man's back. This colour change is not common, in my experience, on the limbs, but is seen more often on the body, especially in connexion with wounds of the extraperitoneal part of the colon. Sometimes it is accompanied by crepitations of the subcutaneous tissue, but is often found without this manifestation. The tissue beneath is sometimes normal, or only slightly oedematous, sometimes distinctly oedematous, sometimes yellow-green in colour. At one time this discoloration is the herald of a violent infection which cannot be controlled by incisions, at another time it will disappear without treatment. The causal agent is, so far as I am aware, unknown.

DESCRIPTION OF COLOURED PLATE.

Figures VIII, IX, and X represent the conditions found at different levels in a single block of tissue from the advancing margin of gas gangrene. Between Figure VIII and Figure IX there is an interval of 2.5 mm. of length, and the same distance between Figures IX and X.

Fig. VIII.—Normal muscle in transverse section, just beyond the edge of the spreading gangrene. (Haemalum and eosin.)

Fig. IX.—Muscle from as nearly as possible the visible advancing edge. Note the marked contrast between the dead coagulated fibres, which are separated off from their sheaths, and the paler normal fibres. (Haemalum and eosin.)

Fig. X.—All the fibres are here degenerated, but their sarcolemmal nuclei still appear intact. Separation of the fibres from their sheaths is everywhere complete. (Haemalum and eosin.)

Fig. XI.—This shows the distribution of organisms at a comparatively early stage. There are large numbers of bacilli in the reticulum, but they have not yet invaded the fibres. This stage is slightly more advanced than that depicted in Fig. X, and the nuclei of the sarcolemma have disappeared. (Leishman's stain.)

Fig. XII.—Phagocytosis of anaërobic bacilli in a zone where the process of gas gangrene has been arrested. The leucocytic reaction is in remarkable contrast with the previous figures. (Leishman's stain.)

Fig. XIII.—A late stage of gas gangrene, showing complete disintegration of muscular fibres and reticulum. In this material organisms were present in large numbers, and frequently in the substance of the fibres. (Haemalum and eosin.)

Colour Changes in the Muscles.

Figure II represents a dissection of the thigh of a man who died from multiple injuries and gas gangrene of the thigh. A wound is present over the vastus externus, part of which has been carried away. The resulting dirty cavity can be seen, as can also the infected subcutaneous tissue, which is of a dirty yellowish-green hue. The vastus externus, although wounded, did not become gas-gangrenous; this may be attributed, perhaps, to the open nature of the wound. The missile passed behind the rectus tendon, and was found lodged against the fibres of the vastus internus. The point of interest lies in the condition of the latter muscle, which was gas-gangrenous throughout. The change in the colour of the muscle is a subtle one, but can be easily seen. Although not so apparent in the reproduction, the same change was present in the outer edge of the lower part of the sartorius, just where it lay in apposition to the vastus externus. The colour of the vastus externus is altered from the normal red-purple to a brick-red. The whole muscle was dead and non-contractile, and some bubbles of gas were visible between the fasciculi. It is to this stage that I have given the name "red death." The other muscles of the thigh were not affected. Death occurred in this case fifty-six hours after the wound was received, and the condition of the thigh was found at the *post-mortem* examination.

The intermuscular connective tissue showed but little alteration in this specimen. This is often the case, but at other times there are distinct alterations. Gas may be found abundantly along the great vessels, and also commonly in the subcutaneous tissues. It is important to note that cultures from such gaseous tissues may prove sterile. At other times the connective tissue is oedematous without being discoloured, and occasionally the appearance is distinctly gelatinous. Later, the oedematous tissue takes on a yellow or yellowish-green colour, but still remains transparent.

Figure III exhibits the changes in the subcutaneous tissues in a striking degree.

In this case there was a compound fracture of the humerus just above the elbow-joint, and, in addition, a penetrating wound of the chest. The patient's condition was so precarious that amputation was considered the best course, especially as there was no radial pulse.

The case is a beautiful example of the involvement of a single wounded muscle, and would have been an ideal one for a local excision had not the arm been shattered and the man's condition dangerous. The supinator longus is seen in the diffluent stage of gas gangrene. The muscle was yellowish-green in colour, and quite devoid of form or tone. It was so soft that it could be moulded or dented with the finger. The greenish-yellow coloration and oedematous state of the subcutaneous tissue are well seen, although before the skin was reflected the external appearances were not marked. The other muscles of the forearm, as can be seen in the drawing, were normal and still readily contractile when examined.

In the small segments of muscle shown in Figures IV, V, VI, and VII it is possible to trace the colour changes in greater detail. All the pieces shown were taken from the gluteus maximus muscle, except one (Fig. VII), which is a portion of a tibialis anticus muscle.

Figure IV is drawn to represent the normal colour of gluteus maximus muscle, the actual specimen being taken soon after death from a patient who died of acute peritonitis. The normal colour, sharpness of outline, and general appearance of the fasciculi, show that the muscle was healthy.

Figure V shows a piece of muscle which was dead, non-contractile, crepitant to the touch, and brick-red in colour. The bubbles of gas, or rather the spaces once occupied by them, are distinctly seen. In this stage the muscle is very friable, and the gas can, by gentle stroking, be pushed about from place to place between the fibres.

Between the normal contractile muscle, as represented in Figure IV, and the condition of "red death" seen in Figure V, there occurs a zone of demarcation which it has not been possible to portray. Here, at the limit of the advancing gangrene, the muscle is simply lighter in colour than normal, but not definitely red. It is firmer in consistence than the normal, and no crepitation can be made out. This advancing edge is more fully discussed in the paper by Captain J. W. McNee and Captain J. Shaw Dunn.

Figure VI shows a piece of muscle from the tibialis anticus at a further stage in the gangrenous process. The colour is now passing gradually from brick-red to an olive-green. The tissue has become more friable, and the consistence may almost be described as "putty-like."

Figure VII exhibits an end-stage, which is not often seen at operation. The colour of the muscle is a greenish-black, and the surface is glistening. Such a piece of muscle is so soft that it tends to flatten out and spread over the surface on which it is placed.

In Figure III the condition of the supinator longus is intermediate between the stages depicted in Figure VI and Figure VII respectively.

I must thank Captain J. W. McNee and Captain J. Shaw Dunn for the care and trouble they have taken to prepare the specimens from which the drawings were made.

Lieutenant-Colonel Frankau and Captains Neligan and Drummond in their paper demonstrate the clinical use that can be made of the pathological fact—namely, the involvement of single muscles in early cases of gas gangrene.

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THE METHOD OF SPREAD OF GAS GANGRENE INTO LIVING MUSCLE.

[WITH COLOURED PLATE.]

BY

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AND

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(A Report to the Medical Research Committee from a Mobile Laboratory in France.)

THIS contribution to the pathology of gas gangrene deals primarily with the method of spread of the acute disease into living muscle.

In our experience gas gangrene is essentially a muscle disease, and we have never seen it commence where injury of muscle could be excluded. The somewhat rare cases of "metastatic" gas gangrene, such as those described by Mullally and McNee,[1] Kenneth Taylor,[2] etc., come into the same category, the primary focus in every instance being in damaged muscular tissue. No example of gas gangrene beginning in, and remaining localized to, the subcutaneous tissue has been met with, and a condition spreading below the skin which is met with in base hospitals would appear to merit some special investigation before a relationship to the general type of gas gangrene can be established.

Clinically, the rapidity of spread of gas gangrene into living muscle, once the disease has begun, is so remarkable as to demand some definite explanation such as has been sought for by histological methods and is suggested here.

The varieties of the acute disease investigated in this way are sufficiently indicated in the articles published by Cuthbert Wallace, and by Frankau, Drummond, and Neligan. Part of our histological material, indeed, was obtained from the actual cases described by these writers.

The disease may commence in a wounded limb within an extraordinarily short time after the injury. The earliest case of gas gangrene examined histologically showed the condition already established three and a half hours after the wound was received, and we have seen massive gas gangrene of a limb lead to a fatal issue twelve hours after a wound of the thigh.

A point worth notice is that death may occur quickly, following a comparatively slight wound, when examination *post mortem* shows gas gangrene involving only a small bulk of actual muscle tissue. The material elaborated by the bacilli, therefore, whether it be a true toxin or not, is at any rate a powerful systemic poison. Sir Anthony Bowlby has pointed out to us that cases of this kind may very readily be mistaken for death from shock alone.

Wounds involving main blood vessels—for example, the popliteal artery—are notorious for the frequency with which gas gangrene develops in the distal segment of the limb, and it is necessary to point out here that there are differences between the spread of gas gangrene following such an injury and the invasion of living muscle. Where the main artery is cut, massive or "group" gangrene generally occurs, whole groups of muscles being involved from end to end simultaneously by the growth of organisms throughout the muscles from which the blood supply has been cut off.

The spread of gas gangrene into living and healthy muscle, with an intact blood supply, is a different and less easy problem, with the solution of which this paper is mainly concerned. With regard to this, two facts must here be briefly brought to mind. One of these is the clinical observation, now well established and borne out by the microscope, that gas gangrene tends to spread in the longitudinal axis of muscles, so that single muscles are involved from end to end while neighbouring ones are untouched. It must also be remembered that individual muscle fibres stretch without interruption from one tendinous attachment to the other.

It is essential, in investigating the spread into muscle, to work on material which is absolutely fresh. Most of the examinations have been made on limbs amputated for gas gangrene, and brought at once to the laboratory while the healthy muscles were still contractile. Other tissues examined were either from single muscles removed by operation or from *post-mortem* examinations carried out within an hour or two at most after death. Unless fresh material is used, quite fallacious conclusions may be drawn, since, especially in summer time, the organisms proliferate and produce gas with extreme rapidity in the warm body after death.

In amputated limbs, and in the stumps left at operations, we have had ample opportunity of proving that the anaërobic organisms are present in the healthy muscle at a considerable distance from the actual seat of the gangrene. Thus the presence of the organisms in the muscles, even though abundant, does not constitute gas gangrene, and, indeed, such infected muscles may never become gangrenous. This is well seen in amputation stumps, known to be infected, but in which no recrudescence of the gangrene occurs after the operation, in a majority of cases.

BACTERIOLOGY.

The bacteriology of the acute disease will be referred to only briefly, as so much has already been published on the varieties of anaërobic bacilli to be found. It is enough to say that all our work has been done on acute and often fulminating cases, such as are seen in casualty clearing stations on the front. In these cases mixed anaërobic infections are the rule, but sufficient work has been done in isolating the different organisms to incriminate the *Bacillus aërogenes capsulatus* (*B. perfringens*) as the commonest and most abundant organism present. It appears often to be the only organism which is isolated from the spreading margin of the gangrene at a distance from the wound. The biology of this organism, with its powerful fermentative action on sugars and resulting evolution of gas, fits in very well with the extraordinary rapidity of spread of acute gas gangrene.

A number of experiments to reproduce a spreading gas gangrene have been carried out in animals to amplify and confirm the findings in human tissues. These will be referred to again later on.

HISTOLOGICAL CHANGES.

The material examined histologically was almost always embedded in paraffin, after fixation in 10 per cent. formalin, or in corrosive sublimate; frozen sections and tissue fixed by boiling were also used for the investigation of certain important points. Muscle taken for examination must be handled with great care or fallacies from artificial separation of the fibres may arise. The histology of single muscles, removed at operation and necessarily pulled on in the act, required, therefore, careful consideration before conclusions could be drawn from the sections. The best material was obtained from amputated limbs, in which the individual muscles could be carefully dissected, and pieces cut out with a sharp knife or razor, all pulling being avoided.

In a few cases only we have had the good fortune to obtain a muscle with fairly long fibres, in which the advancing edge of a spreading gas gangrene could be clearly recognized. It is from these fortunate instances, however, by the examination of serial sections, that most of the information has been obtained of the method of spread. Macroscopically the appearance of this spreading margin is interesting. It is sometimes fairly sharp, but in other instances is irregular, from the process having spread further along some fibres than others. The muscle fibres at the margin are paler and duller than the normal, but the colour change is little more than might be accounted for by total absence of blood in the part involved. The outer limit of the process, while indefinite, can be mapped out fairly closely if the healthy muscle beyond is still contractile (in tissues examined very soon after amputation), as contractility is lost in the part becoming gangrenous. At the advancing edge also the muscle tissue is very much firmer to touch than the healthy fibres beyond, and this firmness passes back into the obviously gangrenous muscle behind.

When the whole of the advancing edge is cut out, along with a margin of tissue on either side of it, and examined in serial transverse sections, the appearances presented are very striking, and are shown in the first three microscopic drawings (Figs. VIII, IX, and X).

Figure VIII represents the muscle in transverse section just beyond the furthest limit of the advancing gangrene; the muscle here was still healthy and contractile. The muscle fibres appear normal, and are seen to be made up of fibrils which show as dots in the transverse section. The cracks in the fibres are artefacts produced in the cutting of the paraffin sections. They occur so constantly in transverse sections of normal fibres that they can almost be taken as characteristic of healthy muscle. The flattened nuclei of the sarcolemma are well seen, and also the interstitial tissue between the fibres, which carries the blood vessels, lymphatics, etc.

Figure IX is from a section taken from as nearly as possible the advancing edge, as seen by the naked eye. The muscle here had lost its contractility. Various normal fibres are seen, with characters as above, while others exhibit a very striking change. The staining reaction is different, being an almost uniform eosin tint, while the dots indicating the individual fibrils are lost. These fibres are not shrunken, but on measurement are often found to be somewhat swollen. In spite of this, however, these fibres are well separated off from the interstitial connective tissue, to leave what appears in the section as a clear space. Occasionally the separation of reticulum from fibre is partial, and confined to a sector only; but even in such instances the fibre still shows the uniform eosin tint indicative of degeneration. The sarcolemmal nuclei of the separated fibres still stain brightly. The contents of the spaces between the altered fibres and the interstitial meshwork will be discussed later, and it may simply be noted here that such fibres are obviously cut off from their blood supply in the interstitial tissue.

Figure X is from a section taken from the tissue 2½ mm. behind the one just mentioned, and in it all the fibres have undergone the degenerative change described above. The fibres are all separated off completely from the interstitial tissue, which forms a regular network between them. The regularity of the network is in no way exaggerated in the drawing, and no difference would be observed in a colour photograph of many of our sections. The nuclei of the sarcolemma are at this stage stained as in the normal fibres.

In longitudinal sections of tissue taken to include the advancing edge, the process is less striking to the eye, as it is impossible to get complete lengths of fibres in any one longitudinal section. The appearances are quite easy to follow, however, having in mind the information obtained from the transverse sections. A fibre which stains normally can often be traced to a point where, quite suddenly and with a very definite edge, the colour change to the strong uniform eosin tint is met with, and the normal striation disappears. Practically coinciding with the colour change, which no doubt represents the margin of death of the fibre, the interstitial tissue is seen to separate off and leave the clear space which is so obvious and striking in the transverse sections.

The significance of these observations may now be briefly dealt with.

In transverse sections stained for organisms these are found far beyond the edge of the gangrene in the interstitial tissue between the healthy fibres. What, then, determines the advancing death of the individual fibres? The whole question seems to us to be bound up in the contents of the spaces left between the degenerated fibres and the meshwork of interstitial tissue. The altered fibres are not shrunken, and the muscle at the spreading margin is tumid and increased in bulk. This swelling is evidently due to the extra room taken up by the spaces described. It was a tempting view to take, that these spaces might be filled by gas alone, which, by the mechanical effect of pressure and by cutting off the fibres from their blood supply in the interstitial tissue, might lead to their speedy death. Attempts were made to prove this view correct by cutting thick frozen sections of fresh unfixed tissues, and looking for evidence of gas under the microscope, but none could be detected. On the other hand, in tissues fixed in corrosive sublimate, and more especially in material fixed by boiling before being embedded in paraffin, evidences of amorphous deposit in the spaces were found, which seemed to point to the contents being a fluid. In tissues fixed in formalin, from which the drawings were made, the spaces almost invariably appeared quite empty, and free from anything which stained. We therefore are of opinion that a toxic fluid, perhaps similar in constitution to the oedema which always accompanies gas gangrene to a greater or less extent, spreads along between the interstitial tissue and the fibres, killing off the latter as it advances. Once the fibres are killed, the anaërobic bacilli live on them practically as saprophytes, breaking down the sugars and producing abundant gas. This process is in strong contrast to what occurs in healthy muscle, where the presence of the organisms is without effect on the living fibres.

The rapid spread of the disease into living muscle can, we think, be explained on these lines. Fibres, each of which stretch without interruption for a considerable distance, are killed in the manner which has been described, and the dead tissue is then rapidly broken down and gas formed. The circle is a vicious one, for the toxic fluid which spreads between the fibres is no doubt formed in the gangrenous tissue behind, and so the condition spreads until the ends of the fibres are reached. This view also gives a satisfactory explanation of how single muscles may be found gangrenous, no spread having occurred to others close at hand. No opinion can yet be given as to the nature of the toxic fluid, which may either be a true bacterial toxin or something dependent on the breaking down of tissues.

Other points brought out by histological examination may now be referred to. With regard to the route followed by the organisms, these are, at the spreading edge, never found in the muscle fibres themselves, but are practically confined to the reticulum (Fig. XI). When the fibres are dead and being broken down, the bacilli invade the disintegrating fibres in numbers. At a later stage (Fig. XIII) all definite muscular structure becomes lost and gas is present abundantly between the remnants of the fibres. It is interesting to note that in muscle at this advanced stage of the disease the number of organisms appears much less than in the spreading zone. This is evidently partly due to many organisms staining badly, so that ghost forms are numerous. It seems probable that this stage, once reached, is inimical to the life of the bacilli, so that many are destroyed and disappear.

In rapidly spreading gas gangrene leucocytes are generally conspicuous by their absence in the muscular tissue involved (although they may be present in some number in the interfascicular planes). The mere speed of progression of the process in muscle may probably account for this, as a leucocytic reaction takes some time to develop. Where the spread of gas gangrene is being arrested in muscle, great leucocytic invasion is present. This is well shown in Fig. XII, taken from a muscle in an amputation stump. Here a recrudescence occurred in the stump, but was arrested after spreading a few inches only. Macroscopically a very definite pale zone was visible, and in section abundant phagocytosis of bacilli by polymorphonuclear leucocytes was found.

Control Experiments on Animals.

A considerable number of experiments have been carried out in animals to control the conclusions arrived at by the study of human tissues. Large rabbits were used, because of their long hind legs, in which the spread of the disease could be watched at different stages. Gas gangrene being a disease of muscle, all the inoculations were made intramuscularly into the gastrocnemius or soleus. Several facts of considerable interest were brought out:

1. A spreading gas gangrene of the limb, quite comparable with the same disease in man, could be produced in rabbits, sometimes leading to a fatal result.
2. The surest method of inducing this result was by the injection of about one cubic centimetre of the fluid expressed from a human muscle showing fairly advanced gas gangrene. This fluid contained abundant bacilli, and all the products of tissue disintegration.
3. When the fluid obtained in this way was first passed through a Berkefeld V filter to remove the organisms, intramuscular injection led to marked local necrosis of muscle fibres, accompanied by considerable leucocytic reaction. No spreading oedema or separation of muscle fibres at all comparable with that described in human tissues could be brought about.
4. A rapidly spreading fatal gas gangrene was produced in one instance only by the injection of a pure culture of *B. perfringens* isolated in culture from a fulminating human case. In this experiment a haematoma of considerable size had been caused in the muscle at the site of inoculation, and this may have provided the dead tissue necessary to start the spreading disease. In tissues from this animal all the changes noted in the spreading margin of the disease in man were perfectly and completely reproduced. In some sections normal fibres were seen lying side by side with others of a deep eosin tint and separated off from the reticulum. At another place the appearances corresponded exactly with those shown in Fig. X, the sharpness and regularity of the interstitial network being very striking.
5. Other experiments carried out with pure cultures of *B. perfringens*, isolated from human cases, led only to a local gangrene at the seat of inoculation, round which a zone of granulation tissue quickly formed, completely walling off the damaged tissue.

CONCLUSIONS.

1. The rapidity of spread of gas gangrene into living voluntary muscle is so remarkable as to require explanation by a different process from that which governs ordinary septic invasion of tissues.
2. It is suggested that the facts are accounted for by the peculiar anatomical structure of muscular tissue. The sheaths enclosing the long individual fibres are so easily detachable as to form potential spaces into which toxic material can readily pass, causing necrosis of the fibres.
3. The early selective invasion of single muscles is consistent with the above view.

We wish to thank Colonel Cuthbert Wallace, C.M.G., consulting surgeon, for his help and interest in this work. The drawings from microscopic sections were made by Sergeant A. K. Maxwell, R.A.M.C., working under the auspices of the Medical Research Committee.

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THE SUCCESSFUL CONSERVATIVE TREATMENT OF EARLY GAS GANGRENE IN LIMBS BY THE RESECTION OF INFECTED MUSCLES.

BY

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AMONG the points brought forward by Colonel Cuthbert Wallace in an article on gas gangrene[1] published in this JOURNAL some months ago were the following:

1. It is rare to meet gas gangrene without muscle injury.
2. It is chiefly a disease of muscles, and is rarely dangerous unless muscle is involved.
3. The lesion in its early stages may be described as a longitudinal one, running up and down the wounded muscles from the seat of the lesion. Muscles, or groups of muscles, are involved, while others escape.
4. It is rare to find all the muscles of a segment of a limb involved, save in a segment distal to one in which the main blood supply has been cut off. Thus the whole leg dies and becomes gaseous when the femoral artery has been blocked in the thigh.
5. There is little tendency for the infection to pass from one muscle to another. This is well shown in amputation stumps, where one muscle dies and becomes gaseous, while the rest of the cut muscles remain healthy.

From our own observations in clearing stations over a period ranging up to twenty-one months it is abundantly clear that these points cannot be controverted. In no case have we seen gas gangrene commencing as a subcutaneous infection; injured muscle is in all cases the initial focus, the appearance of crackling in the subcutaneous tissues being a secondary phenomenon, due to extravasation of gas from the infected muscles below.

RESECTION.

In view of this, it has been our aim to model our treatment on the following lines as soon as the condition is diagnosed: To explore the primary focus with a view to attempting to arrest the infection in the muscle, or group of muscles, involved by resection of the infected areas. Such resection may, as will be seen from the cases, involve a part or the whole of single muscles, or groups of muscles.

Resection should be limited to cases in which the main vessel of the limb is intact, and should be replaced by amputation where the operation must be so extensive as to be likely to give a limb which would be of less value than an artificial limb. Extensive resections, however, may be performed regardless of the ultimate utility of the limb as a life-saving operation, it having been quite clear in some of the cases recorded below that an amputation, as in Case XIII, or a further amputation, in Cases VII and IX, could not have been carried out without very grave risk to life. Resection should extend until muscle is reached which has the following characteristics:

1. The colour is unchanged.
2. The contractility is normal.
3. A good blood supply is present, as indicated by free bleeding from the cut surface.

Experience has shown that even if such muscles are, as they may be, slightly infected, free drainage and an open wound will arrest further development of the condition.

After-Treatment.

The treatment of cases after resection is carried out on the following lines: (1) The dressings are reduced to the absolute minimum—that is, one or two layers of gauze only are placed over the wound so as to allow free access of air and, if possible, sunshine to the wound region; (2) constant or intermittent irrigation of the wound by some modification of the Carrel method—eusol, saline, or hydrogen peroxide being used as the irrigating fluid.

In connexion with the cases described below, the point must be specially emphasized that gas gangrene had already developed in some patients, though they were admitted a very short time after being wounded. In fact, in units at the front established gas gangrene has to be treated *ab initio*, in addition to gas gangrene developing at a later stage.

We are indebted to Colonel Cuthbert Wallace, consulting surgeon to this army, for advice and assistance in the treatment of these cases, and to Captain J. W. McNee and Lieutenant J. S. Dunn, of No. 3 Mobile Laboratory, R.A.M.C., for the bacteriological and pathological investigations they have made in the cases.

CASE I.

Lieut. F., wounded 4 p.m. on November 2nd, 1916, by rifle grenade fragment; admitted at 7.15 p.m. the same day, that is, three and a quarter hours after being wounded.

When admitted he was clearly very ill, although he arrived as a walking case; his pulse was 120, of poor quality and irregular, his tongue was furred, and his features pinched and worn. There was an irregular wound the size of a threepenny-piece (that is, about 1.6 cm. in diameter) on the posterior aspect of the right arm just above the internal condyle of the humerus; there was no exit. The whole upper arm appeared swollen; it was crepitant to the touch, and gave a tympanitic note on percussion. The crackling was most marked on the inner aspect of the arm, and extended as high as the anterior axillary fold above in front, but to not quite so high a level behind.

He was given a general anaesthetic at 8 p.m. The wound of entry was first excised; much damage to the triceps was found locally, and the projectile could be felt to the inner side of the vessels in the front of the arm at the junction of the lower and middle thirds; a second incision was made over this, when the subcutaneous tissues were found to be oedematous, and the biceps muscle showed evidence of gas infection. A further incision was accordingly made along the whole length of the biceps muscle from its origin to attachment; this showed the following conditions: some bruising of the inner border of the muscle at the situation of the projectile; discoloration of the inner half of the muscle, varying from a dull red colour at either end to a deep plum colour in the centre. Over the discoloured area bubbles of gas were present under the fascia covering the muscle. This half of the muscle did not react to tap stimulation, whereas the outer half was normal in colour, and contracted sharply on stimulation. As this appeared to be an infection localized to the inner half of the muscle, the latter portion was resected in its entirety.

A tube drain was inserted into the posterior wound; the anterior wounds were left open, small tubes being inserted for continuous eusol irrigation, which was commenced immediately after the operation was completed. The pulse dropped to 88 six hours afterwards and never rose above this again. The wounds remained clean without pus formation, and on November 9th were closed by secondary suture and the eusol irrigation discontinued. The wounds remained healthy and were practically healed when he was evacuated to the base on November 17th. He had already very fair power in his arm and the remaining portion of the biceps could be felt contracting.

Pathological Report.—An anaërobic gas-forming organism was grown from the excised muscle, which, on histological examination, showed hyaline degeneration of groups of fibres with separation. This condition represents a very early stage in the process of gangrene. Long bacilli could be recognized between the muscle fibres, but they were very scanty.

The extreme rapidity of the infection in this case is remarkable, occurring as it did within three and a quarter hours of the time of injury. It was, in fact, the earliest case we have ever seen. There is no doubt that if any delay had occurred in the treatment the consequences would have been disastrous owing to the virulence of the infection; the patient would have lost his limb if not his life. The treatment by resection of half of the muscle rather than the whole, which at first sight would seem to have been the better course, was due to the fact that the infection is known to spread longitudinally along the length of the fibres and that transverse spread is a late phenomenon occurring in the more advanced stages. The differentiation between living and dead portions of the muscle was made from the presence or absence of contractility, it being well established that heavily infected muscle is non-contractile. (C. H. S. F.)

CASE II.

Lance-Corpl. D., wounded by shell fragment on July 2nd, 1916, was admitted twenty-four hours later, when the following condition was found. Temperature 102.6°, pulse 118; there was a through-and-through wound in the middle of the left upper arm; the arm was greatly swollen in the neighbourhood, and tender on palpation. Subcutaneous crepitation was present.

At the operation, which was performed at once, the biceps muscle at the site of the wound was found to be in a state of "black death," and was full of gas; for two inches above and below this the muscle was non-contractile and in the "red death" stage. A long incision was made over the whole length of the biceps and the entire muscular portion was excised. The wound was dressed with gauze soaked in peroxide until all oozing had ceased, and then was left exposed to the air and sun under a single layer of gauze.

The patient vomited a good deal for two days after the operation, but on the third day this ceased, and his temperature and pulse dropped to normal, and remained so. No other muscle was affected, and the resection was entirely curative, and conserved his limb. He was sent to the base on July 11th with a healthy granulating wound, and a satisfactory report on his condition was received from England on July 26th. (G. E. N.)

CASE III.

Pte. O. was admitted at 7.30 p.m. on October 29th, 1916, suffering from multiple shell wounds received the same afternoon. His general condition was good; there was a penetrating wound of the right chest, an in-and-out wound of the right calf, and a penetrating wound of the right biceps muscle.

The next day he was given a spinal anaesthetic, and the wound in the leg was incised and drained. On the following day his condition was not so good, and he complained of pain in the right arm; pulse 106, temperature 101.8°. The wound in his arm was the size of a sixpence (1.9 cm.), and was situated over the centre of the biceps muscle. The arm was swollen, and the skin was tense and slightly discoloured in the region of the wound. On gentle pressure a small amount of dirty serum with gas bubbles in it escaped from the wound. A general anaesthetic was given, and the biceps muscle exposed by a long incision. In the middle third of the muscle, deeply situated, there was a small cavity containing a fragment of shell; above and below this for a distance of two inches was an area of dead crepitant muscle. The whole necrotic area was excised until healthy muscle was reached, which bled on section. The wound was left freely open, and dressed with eusol gauze.

He made a straightforward recovery, and was evacuated to the base on November 12th. The wound in his arm was then healthy and ready for secondary suture.

In this case immediate improvement followed resection of the infected muscle. (H. D.)

CASE IV.

Pte. G., wounded on July 24th, 1916, was admitted the same day with shell wounds of the right buttock, right calf, and skull.

Immediate operation by trephining; wounds of buttock and calf drained and a piece of metal removed from the soleus muscle.

Twenty-four hours later the calf was very swollen and tender and gas bubbled from the wound on pressure; the temperature was 102° and the pulse 112. An anaesthetic was again given and the calf opened up from the lower part of the popliteal space to 3 in. from the ankle. The gastrocnemius was split down the mid-line and found to be healthy and contractile; the soleus beneath along the track of the projectile was found to be in the "black death" stage of gangrene; it was crepitant and no part of the muscle was contractile. As much as possible of the muscle was cut away and the wound was flushed out with peroxide and left open to the air, the limb being slung in a cradle for this purpose. The patient was given 100 c.cm. of 5 per cent. eusol solution intravenously at the end of the operation.

Rapid improvement followed; the temperature and pulse dropped to normal on the next day, and he was evacuated to the base on July 30th, with normal temperature and pulse. The head wound had healed and the other wounds were clean.

A note from the base hospital stated that he was sent to England on August 5th, 1916, having made an uninterrupted recovery. (G. E. N.)

CASE V.

Second Lieut. G., wounded in the left leg by a rifle bullet at close range at 2.30 a.m. on October 11th, 1916; he was admitted at 9 a.m. and operated on immediately.

There was a through-and-through wound in the upper and outer part of the left calf, the wounds of entry and exit being of about the same size and just large enough to admit the tip of the finger. The wounds were excised and freely drained by means of two large tubes after irrigation with eusol; the wound appeared to be a comparatively trivial one.

Eighteen hours later the pulse, which had been previously normal, ran up to 120, and he showed signs of profound toxaemia; the upper part of the leg was swollen and tender and the skin was glazed; there was no subcutaneous crackling. An anaesthetic was again given and the entire track of the wound, which was about three inches long, was laid open by division of skin and intervening muscles. The peroneus longus and brevis muscles were found to be considerably lacerated; they were altered in colour, crepitant, and non-contractile. The dead portions were cut away until healthy bleeding muscle was reached, which contracted on stimulation. The wound was left open and treated with continuous eusol drip irrigation.

Immediate improvement followed, the pulse dropping to normal within a few hours. He was evacuated to the base nine days later with a healthy granulating wound.

Anaërobic gas-forming organisms were found on culture in the dead muscle removed.

This case is of interest, as the infection commenced in spite of free and early drainage. Resection of the infected area cut the process completely short. (C. H. S. F.)

CASE VI.

Corpl. E. was admitted at 5.30 p.m. on August 27th, 1916, having been wounded by a shell fragment at 7 p.m. the previous day. On admission he looked flushed, the tongue was dry, the pulse 126, and the temperature 103°. There was a wound of entry the size of a shilling (2.3 cm.) over the anterior tibial group of muscles at the junction of the middle and lower thirds of the leg; the wound of exit was 2 in. above the ankle-joint on the posterior aspect of the limb in the middle line. The missile had passed between the two bones of the leg. The limb was very swollen in its lower half and the skin had a white, tense, glazed appearance; there was considerable pain on palpation. No subcutaneous crackling was elicited.

On raising the limb under the anaesthetic, gas bubbles escaped from the anterior wound with some foul stinking serum. The skin wound was excised and the anterior tibial group of muscles were explored through a 6 in. incision. The extensor longus digitorum muscle was exposed, this had been divided across by the missile; the retracted ends showed an opaque sheath with underlying dead non-contractile muscle for an inch on either side of the wound. The dead portions were cut away until normal vascular muscle was reached at either end. About two and a half inches in all were cut away from either end; the anterior tibial artery was exposed at the bottom of the wound, but was uninjured. The extensor longus hallucis looked healthy and contracted well. The posterior muscles were not markedly damaged and were not interfered with. The wound was drained and drip irrigation with eusol commenced.

The patient made an uninterrupted recovery, and was evacuated to the base on September 3rd; his pulse was then 90 and his temperature 99°. The wounds were granulating.

An anaërobic gas-forming organism was isolated from the removed muscle, which, on section, showed necrosis and irregular fragmentation of muscle fibres; there was oedematous thickening and leucocytic infiltration of the interstitial connective tissue. Large bacilli were present in considerable numbers between the dead fibres.

This case clearly shows the longitudinal spread of the infection in the muscles and how free resection of the diseased muscle arrests any further spread of the infection. (H. D.)

Case VII.

Pte. C. was wounded at 4 p.m. on July 29th, 1916, by a shell fragment in the region of the left knee. On admission five hours later his condition was very bad owing to loss of blood; the pulse was 150.

Six hours later after warmth and stimulation he was fit for operation, and the wound was explored. There were two lacerated wounds on each side of the popliteal space which had evidently been traversed from within outwards; examination showed an extensive fracture of the head of the tibia involving the knee-joint. The pulsations of the main vessel could not be felt; the gastrocnemius and soleus muscles were extensively lacerated. The wound was freely drained after irrigation with eusol.

The next day his condition was satisfactory until 8 p.m., when his pulse was 120 and his temperature 102.4°. The region of the wound was more swollen and the skin over the calf had the appearance of a bruise which was fading; percussion gave a tympanitic note over this area; there was no subcutaneous crackling. The knee-joint was also resonant from the presence of gas. The lower third of the leg was cold, and there were several light purple patches over the dorsum of the foot.

The leg was removed by disarticulation at the knee-joint; examination showed occlusion of the popliteal artery from a bruise wound and a large hole in the popliteal vein—the gastrocnemius and soleus muscles showed marked gas gangrene.

He was much improved the next day, but on the following day his pulse was 120, and his temperature 101.4°; the lower third of the thigh was swollen, tender to the touch and resonant to percussion; it was evident that the infection was spreading up the muscles of his thigh. Under chloroform an incision was made up the back of the thigh and the semimembranosus muscle was found to be gaseous and stinking. It was followed up to the middle of the thigh and resected at this point as the fibres were found to be healthy there. The anterior aspect of the thigh was then explored and the sartorius muscle found to be similarly infected in its lower part; the distal four inches were resected through healthy muscle.

The wounds were left exposed to the air, being covered by one layer of gauze only; the wound was kept irrigated by a constant eusol drip. The thigh was slung so as to take the weight off the muscles of the back of the limb; suspension was effected by means of a gauze band attached to the exposed condyles of the femur. From this time on he commenced to improve; on the following day his pulse was 96 and temperature 101°. On August 3rd the stump of the popliteal artery, which was lying in a bed of sloughing muscle, commenced to ooze; in order to avoid a secondary haemorrhage the femoral artery was ligated in Hunter's canal under local anaesthesia. After this he continued to improve, and was evacuated to the base on August 15th.

The muscles were infected with a pure culture of *B. perfringens*.

It was impossible even to attempt to save the limb in this case by resection of muscle in the first instance owing to the occlusion of the popliteal artery. When the secondary spread of infection occurred into the thigh muscles after the amputation his general condition became rapidly so bad that a further amputation would have been inevitably fatal. Resection of the infected muscles was the only satisfactory course to adopt, as proved to be the case. (H. D.)

Case VIII.

Pte. P., wounded August 28th, 1916, was admitted the same day. There was a through-and-through wound of the left thigh, with compound fracture of the femur in the upper third. He had had much haemorrhage before admission, and was very collapsed on admission; pulse 140, temperature subnormal.

Twelve hours later he had improved sufficiently for operation; both wounds were freely opened up, lacerated muscle, fragments of bone, and the case of a bullet being removed. The outer wound was kept open with a silver retractor, and both were lightly packed with eusol gauze. The limb was immobilized on a Wallace-Maybury splint, and the wounds were syringed every two hours with eusol.

The patient had a good night, but next morning his temperature and pulse began to rise; he complained of pain in the limb and of great thirst, and the tongue became dry and brown. The limb was found to be swollen and tense, and had a characteristic odour. There was no skin crepitation and no gas bubbles from the wound. An immediate "chaff-cutter" amputation just below the trochanters was performed; as the adductor muscles were found to be in the red stage of gas gangrene, they were completely excised from the stump. The wound was dressed for twenty-four hours in gauze soaked in peroxide, and then left exposed to the air under one layer of gauze.

Within two days the temperature dropped to normal and the pulse to 90; none of the other muscles in the stump showed any sign of being infected, and he was evacuated to the base on September 15th with a granulating wound.

A laboratory report confirmed the diagnosis of gas gangrene.

This method of removing a group of infected muscles was also carried out in another case five days after amputation, the adductors here being also removed. No spread occurred in the other muscles. (G. E. N.)

Case IX.

Lieut. B., wounded at 1 a.m. on September 13th, 1916, by shell; the right leg was shattered in the lower third. He was admitted at 3.30 a.m. the same day.

Primary amputation by equal lateral flaps at the middle of the leg was performed at 4 a.m. It was noticed at the operation that the anterior tibial artery was occluded; there was no change in the muscles, which were contractile and apparently healthy. The wound was freely irrigated with eusol, and the flaps which were free were united loosely with three sutures. Free drainage was provided by means of two tubes, which also served for constant eusol irrigation, which was started at once. The pulse before the operation was 90; at the end it was 88.

Twenty-six hours later the pulse ran to 120, the tongue became furred and dry, and the patient was drowsy and obviously very ill. Examination of the wound showed mottling of the skin over the front of the leg, together with a tympanitic note on percussion over the same area; there was no crackling of the subcutaneous tissues. The wound was at once opened up, when it was found that the entire anterior tibial group of muscles were a brick-red colour, non-contractile, and quite dead. They were removed *en masse* and the wound was left open under constant eusol drip irrigation.

The general condition remained bad for twenty-four hours, with rapid pulse, drowsiness, and persistent vomiting. Steady improvement then followed, and the patient was sent to the base on September 22nd with a healthy granulating wound.

The removed muscles were found on culture to be heavily infected with gas-forming organisms.

The only other alternative in this case would have been a further amputation through the thigh, which it is doubtful if the patient would have survived. Resection of the muscles avoided this additional danger and gave the patient a much more serviceable stump, as the knee-joint was saved. (C. H. S. F.)

Case X.

Pte. P. was wounded by shell fragment on July 23rd, 1916. When admitted on July 24th the temperature was 103.6°, and the pulse 120. There was a through-and-through wound of the left thigh, the entry being on the inner side, 3 in. above the patella, and the exit 2 in. higher up on the outer side. The exit wound was swollen, tense, and tender, but did not crepitate.

Both wounds were excised and united by incising the skin. There was some laceration of the edge of the vastus internus; this was cut away; the muscle looked normal, and was contractile. The rectus femoris was grooved on its under surface, but appeared otherwise normal. The exposed inner edge of the vastus externus was brick-red and non-contractile, and smelt strongly of gas gangrene. An area of 4 in. by 2 in. of the muscle showed signs of red death; the parts beyond were normal and contractile. A free skin incision was made, and a piece of muscle 8 in. by 3 in. enclosing the affected area was excised. The wound was dressed in gauze soaked in peroxide, and later exposed to sun and air.

The temperature and pulse steadily fell, and by July 30th were 99° and 76 respectively. He was sent to the base on that day; the wound was then healthy and granulating, and there was no sign of further gas infection.

A report from the mobile laboratory stated that the infection was due to an anaërobic gas-forming organism. (G. E. N.)

Case XI.

Pte. M., wounded on August 29th, 1915, by shell fragment in the left groin. There had been much haemorrhage at first, necessitating saline infusion in the field ambulance, where he was retained until midday on August 31st.

On admission his condition was grave; tongue brown and dry, pulse 130. There was a ragged wound of entry the size of a shilling (2.3 cm.) an inch and a half below Poupart's ligament and just to the inner side of the femoral vessels; the skin over the upper third of the thigh and for a handbreadth above Poupart's ligament was mottled and discoloured, and showed marked subcutaneous crackling.

An anaesthetic was immediately given, and the wound opened up; it was found to extend upwards and outwards towards the anterior superior spine, where a fragment of metal and khaki was found in the sartorius muscle. The muscle in this situation was dead, and the upper third was cut away. The discoloured and crepitant areas were incised down to deep fascia, and freely injected with hydrogen peroxide. No dressing was applied, and the wound was kept constantly irrigated with hydrogen peroxide and left exposed to the air and sun.

Rapid improvement took place, and the man was evacuated to the base with a granulating wound twelve days later. No bacteriological examination was made, but there was no doubt about the condition.

At the time when this case came under treatment the significance of the muscle resection was not realized, but it seems at least probable that it cut short the process by removing the main focus of infection. (C. H. S. F.)

Case XII.

Lance-Corpl. C., wounded in the left thigh by a shell fragment at 3 p.m. on March 13th, 1916, was admitted into hospital at 2.30 p.m. the following day.

On admission he looked flushed, the temperature was 102°, and the pulse 120. There was a jagged wound two inches long on the outer aspect of the lower third of the left thigh. There was no exit wound. The lower part of the left thigh was swollen and tense, and the overlying skin shiny. There was tenderness on palpation, and a tympanitic note was obtained on percussion; there was no subcutaneous crackling.

At 5.30 p.m. on the same day a long incision down the outer aspect of the thigh exposed the vastus externus muscle, of which the lower half was markedly affected with gas gangrene. A portion of the muscle near the wound of entry was black in colour and the muscle fibres were diffluent. The lower part of the muscle was resected up to the middle of the thigh, where healthy contractile muscle was found. As the muscle planes were separated by gas up to the level of the great trochanter, the skin incision was carried up to this level. The whole wound was left wide open and dressed with eusol gauze. At 9 p.m. the same evening he was given an intravenous injection of eusol 100 c.cm.

The pulse dropped the next day, and he showed great improvement; this was maintained, and he was evacuated to the base six days later. Information was received from England a week later that he was progressing well.

An anaërobic gas-forming organism was obtained on cultivation from the muscle removed. (H. D.)

Case XIII.

Pte. B. was wounded by shell fragment on September 1st, 1916, and admitted the same day. There was a through-and-through wound of the thigh, the entrance being on the inner side two inches below Poupart's ligament and the exit at a corresponding point on the outer side.

Under an anaesthetic the skin wounds were excised and the track syringed with eusol and drained.

Fifteen hours later the patient complained of great pain in his thigh and of great thirst; the temperature was 101° and the pulse 110. The wound was found to be tender, crepitant, and gassy.

An anaesthetic was again given, and the whole track of the missile laid open; the sartorius, rectus femoris, and the inner edge of the vastus externus were found to be in the "black death" stage of gas gangrene. An incision was made from the anterior superior iliac spine to the knee and another along the inside of the thigh; these were stitched back to healthy skin so as to expose the wound fully. All three muscles showed the "black death" stage of gangrene at the site of the wound, toning down through the "red death" stage to normal muscle as the muscles were traced down the thigh. The muscular part of the rectus femoris was removed, and also the sartorius from its origin to just above the knee. A strip of the vastus externus for nearly its entire length and for a width of 3 in. was also excised. No other muscles appeared to be affected; the wound was dressed with gauze soaked in peroxide, and afterwards exposed to the sun and air.

For three days he was very ill, with rapid, feeble pulse, constant hiccough, and persistent vomiting; he however slowly improved, and on September 5th his pulse was 88 and temperature 100°; the hiccough still persisted. Two days later a part of the skin flap sloughed, after which he improved steadily, and was evacuated on September 11th with a healthy granulating wound, which was skin-grafted at the base hospital.

The diagnosis of gas gangrene was confirmed by the mobile laboratory. (G. E. N.)

Case XIV.

Corpl. V., wounded in the left thigh by a shell fragment at 5.30 p.m. on September 19th, 1916, was admitted five hours later.

His general condition was good; pulse 100, temperature 99°. There was an entry wound the size of half a crown on the inner and posterior aspect of the thigh at the junction of the middle and upper thirds. The exit wound was at the outer side of the thigh in the middle third; it was very large, admitting the whole hand; the muscles were greatly lacerated. He was operated on immediately after admission; the missile had passed through the vastus externus and biceps muscles close to the femur, and had partially divided the sciatic nerve. The wound was freely drained after irrigation with eusol.

He continued to do well for two days, when the evening pulse rose from 104 to 132, and the temperature to 102°. The skin over the exit wound was now a dirty-brown colour, and the area in the neighbourhood was swollen and tender; there was no subcutaneous crackling. The skin discoloration extended to the popliteal space. A further anaesthetic was given, and the large exit wound was laid freely open. In the lower part of the wound the vastus externus muscle was found to be gangrenous; it was non-contractile and gaseous. The infected portion of the muscle was resected until healthy muscle was exposed. In the upper part of the wound the vastus externus was pale and contracted feebly; with clean instruments a piece was removed for examination, and the skin was laid freely open over the muscle. Eusol dressings were used.

Immediate improvement followed, and he was evacuated to the base on September 26th, with a normal temperature and pulse.

Anaërobic gas-forming organisms were cultivated from the dead muscle, and were also obtained on culture from the portion of muscle removed from the upper part of the wound.

This case shows the immediate improvement after resection of the infecting focus, and also that muscle may look healthy and be contractile, and yet be infected. (H. D.)

Reference.

[1] Gas Gangrene as Seen at the Clearing Stations, British Medical Journal, September 16th, 1916.

CHAPTER VII.

THE DEVELOPMENT OF BRITISH SURGERY IN THE HOSPITALS ON THE LINES OF COMMUNICATION IN FRANCE.

BY

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THE general hospitals on the lines of communication in France have undergone a steady process of extension in accommodation and development since August, 1914. They have been housed very variously—some in the original tent units, some in huts, and some in large buildings adapted to their present purpose. Tented units under the climatic conditions of France have proved to possess but one virtue, that of mobility, and in all the tented hospitals still remaining a certain proportion of huts for serious cases, operating theatres, mess accommodation and stores and offices, have been added. The most satisfactory units are hutted throughout, and these leave little to be desired either for comfort or for satisfactory work, even when compared with the civil hospitals at home. Most of the buildings now in use are either of the nature of public buildings or of large hotels. Each possesses some special advantages. The large rooms of casinos, etc., form excellent wards, easily overlooked and economical to work, but such buildings need usually considerable reinforcement with regard to sanitary accommodation. The hotels are more convenient for officers as providing a large number of smaller rooms, but this necessitates a somewhat larger nursing staff, and renders attention to individual patients a more troublesome task.

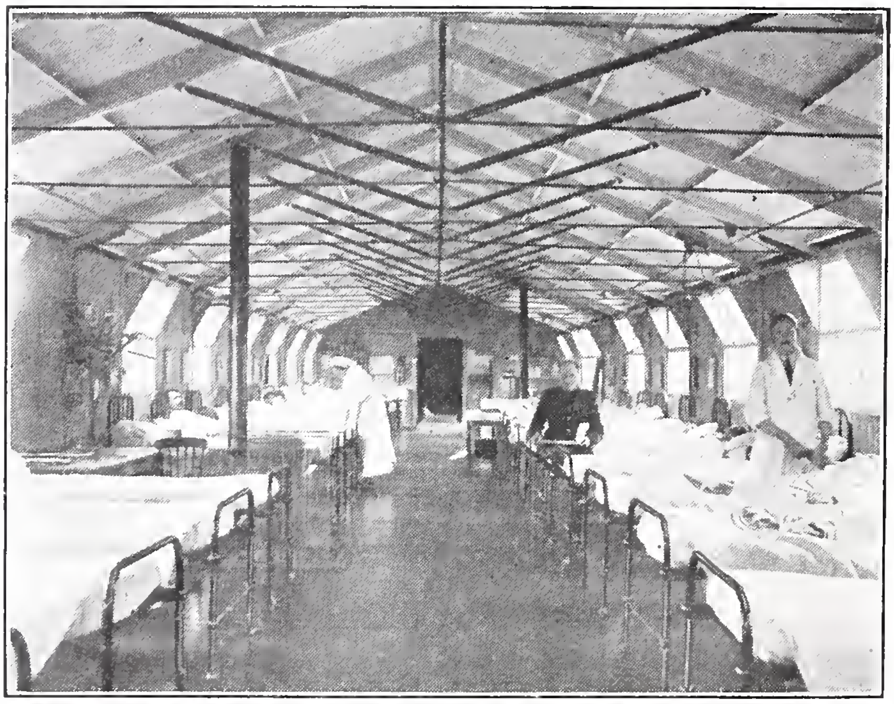

FIG. 1.—Interior of a ward at a general hospital at a base in France.

Special hospitals are set apart for the treatment of infectious cases, for skin diseases, and for venereal cases.

All the Dominions are represented. Thus Canada, Australia, New Zealand, and South Africa have all provided general or stationary hospitals in addition to the more mobile units present in the advanced lines. There is also an American voluntary unit.

Each unit is complete in itself, possessing operating theatres, clinical laboratory, and its own disinfecting apparatus. The only department that is commonly massed when a number of units are collected in the same area is the mortuary and accommodation for *post-mortem* examinations. The majority of the units—the normal capacity of which is 520 beds—have been extended by the provision of additional ward accommodation to receive 1,040 patients, while in times of stress a further extension to 2,000 is possible by the addition of tents. The number of patients which may need to be dealt with during active fighting may be very large; thus during the first three months of the action on the Somme as many as 8,500 wounded men have been passed through a single unit. This necessitates ample operating theatre accommodation, and in all either a large theatre is provided, or in one type of unit two, so that at least four operating tables can be kept at work contemporaneously. In spite of these provisions, at busy times the surgeons may be engaged continuously in shifts for two or three days and nights without cessation.

Within certain limits, arrangements exist for the aggregation of special classes of injury, such as fractures of the bones of the limbs, injuries to the face and jaws, compound and complicated fractures of the skull and vertebral column, and wounds of the chest.

In connexion with each large hospital camp convalescent camps are established, and life in these is rendered more pleasant to the men by the provision of the social huts of the Young Men's Christian Association, the Church Army, and other bodies.

HOSPITAL TRAINS AND MOTOR AMBULANCES.

The vast majority of the patients admitted to the general hospitals are brought down by the hospital trains. Although even the best of the present trains can only be said to be a slight advance on some of those in use during the South African campaign, or those already provided for transporting the patients on their arrival in port in England at the commencement of this war, yet the development of the hospital train in France was a matter of extreme urgency and great difficulty in the initial stages of this campaign. It seems as if both France and Germany had relied for the railway transport of the wounded on the same means which served the purpose in the war of 1870–71. In fact, with the exception of the addition of frames for carrying stretchers placed on the floors of merchandise wagons, no special arrangements appear to have been made. The trains conveying the wounded from the front were provided with no permanent arrangements for cooking food, no sanitary conveniences, no provision for the carriage of water, and, in fact, consisted of a mere string of trucks, with no means of intercommunication to allow the attendants to pass readily from wagon to wagon. To add to the miseries of the journeys made in these trains, they were long, sometimes extending over two or three days before the west coast was reached.

A small difference in gauge in the French and English lines prevented the prompt shifting of English hospital carriages across the Channel, and too great praise cannot be accorded to the officers who set to work to improvise more satisfactory means of railway transport. Odd carriages of every build and description were obtained whenever opportunity offered, and within a few weeks with alterations hastily but effectively carried out, a number of efficient if not luxuriously appointed hospital trains were forthcoming, and it says much for the officers who did this work that although at the present time over thirty hospital trains are running, no less than seven are of the original improvised series, and are still found efficient.

One word should be added regarding the fleet of improvised barges which run on the canals between the front and two of the general hospital areas. There is no doubt that the smooth passage of these boats provides the acme of comfort for patients to whom the unavoidable shaking of a railway journey entails both pain and harm. It is unfortunate that the general utility of the barges is limited to the few districts in which canals are to be found.

The splendid motor ambulance convoys attached to each district, and for most of which the army is indebted to the Red Cross Societies of the United Kingdom and the Colonies, have been already referred to as to their work at the front, and no further mention of their devoted work is necessary at this place.

As to the last link between the general hospitals on the lines of communication and the base in England, the hospital ships, it suffices to say that they leave nothing to be desired.

WOUND TREATMENT.

This question, which has exercised the ingenuity of man since the birth of surgery, has abated no jot of its capacity for arousing controversy and avoiding a solution which can satisfy all.

Experience has in no way controverted that gained in civil practice in the use of aseptic methods, but has, on the other hand, proved conclusively that advance in the treatment of septic wounds has had in this campaign to start from an unfamiliar standpoint, and has progressed but slowly. Practical application has demonstrated the superiority of the Listerian principle and method, but the multiplicity of the chemical media employed affords evidence enough of the difficulty met with in establishing any one means as that suitable for every class of case. On two points alone can no difference of opinion exist: (1) The urgency of an efficient primary mechanical cleansing and exposure of the wound cavity, and (2) the importance of maintaining the wounded part at rest. The latter point raises the first great difficulty which has to be met by the military surgeon, the absolute necessity of early transport of the wounded man; and leads directly to a second, the amount of interference advisable in wounds which have reached the "intermediate stage," that is, the period of established infection during its first phase, the condition, in fact, in which a large proportion of all gunshot wounds reach the general hospitals on the lines of communication.

Speaking generally, it has been shown that if the primary mechanical cleansing of the wound has been thoroughly carried out, no further gross intervention should be necessary; further, that if want of time and medical officers has not allowed of this procedure being fully carried out, yet if the wound has been sufficiently opened up and primary drainage ensured, the subsequent treatment is comparatively simple. From the point of view of the surgeon on the lines of communication, free incisions are never objectionable, provided they be made in such directions as not to render the subsequent secondary closure of the wound impracticable, the one structure for which he pleads avariciously being the integument. The primary cleansing, given satisfactory surroundings, cannot have been undertaken too early, as every hour of delay adds to the subsequent task of dealing with the infection. In this relation the immediate removal of shell fragments and clothing is of the first importance, because if allowed to remain the deferred operation, even in minor wounds, may prove a procedure of great danger when the patient has arrived at the general hospital on the lines of communication. Such an apparently trivial operation may be followed at this stage by an acute extension of anaërobic infection involving the whole segment of a limb, the entire member, or indeed be sufficiently extensive to lead to the loss of the limb, or even the patient's life.

The conditions of war, however, not infrequently prevent an ideal early treatment of the wounds. It may be impossible to remove patients from "No Man's Land," or even from the trenches, for many hours or even days after reception of the wound. On the occasion of serious fighting the number of the wounded may make it impossible for the requisite amount of time to be spent on individuals, especially those less seriously injured. Lastly, unavoidable delay in transport may result in extension of infection and conversion of a promising case as it left the casualty clearing station into one arriving at the general hospital in a highly unsatisfactory condition.

Happily, whatever the initial procedure and application may have been, in many cases the young and healthy patients arrive in good general condition, the local wound progressing satisfactorily, in some instances devoid of any serious infection. In a considerable proportion, however, men are admitted suffering, both generally and locally, with every grade of infection from the slight to the most severe. The former class present little difficulty, the wounds heal readily under any form of simple application, or, as a time-saving and precautionary measure, the smaller wounds may be completely excised and the gap sutured. The latter method, especially advocated by Colonel H. M. W. Gray, has been attended by success in his own hands and in these of other surgeons, particularly in the case of uncomplicated scalp wounds or the smaller multiple injuries inflicted by fragments of shells or bombs.

A vastly more difficult problem is presented by patients arriving in the stage of acute development of infections. The wound has already been primarily opened up and cleansed, and the question arises whether further surgical interference will effect improvement or lead to increased extension of the infective process. On the one hand, it is evident that the patient is suffering from an exacerbation directly due to the disturbance involved by transport; on the other, the possibility is always present that delay, even of a few hours, may allow such progress as to render any further intervention useless. A rough-and-ready distinction between cases in which clinical evidence suggests anaërobic or aërobic infection respectively to predominate forms the most useful guide. In the former case delay may be fatal to life or limb, in the latter an interval of rest often results in a rapid subsidence both of local signs and general symptoms, and no further incision may be required.

Patients arriving at the general hospitals may have been submitted to several varieties of primary wound treatment. Speaking generally, the principles adopted have consisted in the maintenance of rest, moisture, and an antiseptic application. In the earlier stages of the campaign numerous antiseptic solutions were employed, also the hypertonic saline solution, but of late, in the great majority of cases, solutions of which the active constituent is chlorine have found most favour and have proved the most satisfactory in practice. Eusol, and with gradually increasing frequency the Dakin-Daufresne solution of hypochlorite of sodium, are those now most commonly resorted to. In the case of the former, moist gauze dressings, in combination with ordinary rubber drainage tubes, have been generally employed; for the latter the technique of Carrel is used.

A smaller number of cases have been treated by other methods, such as primary suture, the salt pack, closure after the introduction of a mixture of iodoform, bismuth subnitrate and paraffin (Rutherford Morison's method), a solution of brilliant green, etc. A word may be added regarding the salt pack method advocated by Colonel H. M. W. Gray. This method, consisting in a thorough packing of every crevice of the wound with gauze, between the layers of which tablets of sodium chloride are enclosed, is suitable for wounds of the large funnel type or of a superficial nature. It is not safe for tunnel wounds, wounds implicating the large vessels, or highly comminuted fractures. The early action of the sodium chloride is inhibitory, and gives no aid to the healing process; indeed, the tablets, even when enveloped in gauze, cause local necrosis of the tissues opposite to them. On the other hand, wounds dressed in this manner may be left untouched in many cases for a week or ten days, during which period the patient's general condition remains excellent. The pack, acting as a foreign body, excites a local reaction around the wound, with a consequent narrow wall of inflammatory infiltration which protects the general system from the absorption of toxic products from the wound. Suitable cases dressed in this manner arrive in a surprisingly good condition at the general hospitals, and the wounds do well with subsequent cleanly antiseptic treatment. Subsequent introductions of the pack are neither conducive to rapid closure of the wound, cleanliness, nor the amenities of the ward, and are undesirable.

It may be well here to mention the experience which has been gained as to three points in the technique of the treatment of septic wounds—drainage, irrigation, and baths.

Drainage.

The methods of maintaining the free escape of septic discharges from the wound have undergone considerable modification, although no doubt has arisen as to the cardinal importance of the principle to be carried out. In the earlier stages of the war it was effected mainly by the introduction of rubber tubes of large calibre and other devices, and these were retained for prolonged periods at the general hospitals. The objections to this method—the tendency of the tube to form for itself a localized channel useless for general escape of fluid, the presence of a foreign body in the wound capable of exercising injurious local pressure, the establishment of a track by which infection could be freely conveyed from the surface to the depths of the wound cavity, and lastly, the difficulty of determining the moment at which the tube might be safely removed after its prolonged stay—were obvious, but they were faced for a time in view of the very serious infections that had to be dealt with. A revulsion, however, soon followed, in consequence of the unsatisfactory results attained, and the tube is now retained as a provisional measure, and in many cases not employed at all. The main element in the decreased use of the cylindrical tube has been the introduction of what may be called the "curtain" method. This is well illustrated in two forms by Carrel's and Rutherford Morison's systems respectively. In Carrel's the wound surfaces are kept apart not by the small tubes employed for the purpose of instillation, but by the layer of fluid constantly renewed between them and the light gauze packing introduced to retain it. In Rutherford Morison's, a thin layer of an antiseptic medium covers every part of the surface of the exposed tissues, and forms a curtain or cleft which allows for the escape of such fluids as may collect within the wound. The drainage effected by the salt pack is of a similar character, supplemented by the absorptive power of the pack itself before it becomes thoroughly impregnated with the discharges.

Irrigation.

Continuous irrigation has greatly lost in favour; it has the primary objection of inconvenience to the patient, while experience has demonstrated the difficulty of preventing the fluid from forming definite runlets, and consequently of ensuring the flow of the fluid employed over the whole surface of the wound. Its use has consequently been more and more restricted; and, except in the form of a periodical flush, irrigation is little employed.

Baths.

Antiseptic baths have also lost in favour with the development of more effective antiseptic methods. Beyond the obvious difficulties of so arranging the limb as to avoid pressure and swelling (a difficulty, by the way, much diminished by the excellent form of bath devised by Captain M. Donaldson), the bath entails the serious disadvantage, in dealing with a septic limb, of the impracticability of preventing hurtful movements of the part.

At the present time the most successful results that are being attained in all forms of wound are undoubtedly those in which the Carrel-Dakin method is employed. This method has not only shown itself successful in the early treatment, but also in the later treatment of septic wounds, even in the stage of chronic established suppuration. It has been definitely proved that simple flesh wounds dealt with during the first twelve hours after infliction can be rendered practically sterile in an average of six days, those dealt with later in an average of twelve days, that compound fractures may be sterilized within three weeks, and that all three classes of case may be secondarily sutured and closed at these dates. Economy in time, diminution in the risks of secondary complications, increase in the comfort and well-being of the patient during treatment, are all ensured by the method.

It also ensures what has become the supreme object in dealing with septic wounds, the possibility of early secondary suture. The importance of using a bacteriological test to determine the date of closure of the wound cannot be too strongly impressed if anything like habitual success is to be attained. Opportunity has not yet been afforded for the trial of the method during a great rush of wounded men, but arrangements have been made to carry it out if possible. Even should this prove impracticable, the system can readily be carried out in quieter times for a very large number of patients. It has one obvious advantage over any other method of treating septic wounds, the production of a thin supple scar, not likely to interfere with the mobility of the parts, or to cause trouble by subsequent contraction.

The alternative method of secondary closure (that of Rutherford Morison[1]) avoids the tedious process and careful manipulation essential to the success of Carrel's method, saves much time on the part of both surgeons and nurses, and the patient has not to undergo the discomfort of repeated dressings. Little experience has yet been gained of its suitability as a primary procedure, but in infected suppurating wounds it has attained great success. It must, however, be allowed that the cicatrix obtained is very inferior to that which follows the use of Carrel's system, from the initial period onward, and the inclusion of particles of bismuth and iodoform has some disadvantages, both immediate and remote. One great advantage of Rutherford Morison's method is also lost in the cases treated by it in a field ambulance or casualty clearing station—the patients must undergo transport with its consequent shaking and disturbance of the wound; hence patients with the slighter injuries, whose wounds have been closed by this method often arrive with the composition escaping from a wound in which little or no union has taken place, and no appreciable benefit has been conferred.

While it may be said fairly that the Listerian principle has been more nearly attained by the method of Carrel than by any other in use, and that the results are of a very satisfactory nature, yet it must still be allowed that an ideal antiseptic medium remains to be found, especially in respect of consistency of strength and persistence in action. In both respects the bismuth iodoform methods offer some advantages to make up for the cruder character of the cosmetic results obtained. In France the surgeon, like the modern Jew, still awaits the advent of the Messiah; perhaps that advent is near in the person of flavine. Meanwhile, we rest in hope and happy in the firm belief that "the stimulus of imperfection taking place immediately calls forth the action of restoration," and the struggle is maintained to further the great principle, "the first and great requisite for the restoration of wounded parts is rest, as it allows that action which is necessary for repair to go on without interruption," a struggle which only the military surgeon on active service can fully appreciate.

SECONDARY HAEMORRHAGE.

In the light of modern surgery this accident has been deplorably common, and though but little new has emerged from the experience of the war, a few remarks upon the subject seem warranted, the more so in that the increasing frequency with which transfusion of whole blood has been employed to counteract the effects of the accident does show some advance in treatment.

As a manifestation of septic infection, it is obvious that improved methods of wound treatment offer the best chance of reducing the frequency of secondary haemorrhage, and it may be confidently stated that with the development of more satisfactory methods the accident has become less common. Still it must be recognized that in dealing with gunshot wounds we are likely to be of necessity limited to the process of secondary sterilization of an infected wound; further, that we stand in the face of a variety of wound in which incomplete primary lesions of the blood vessels are more common than in any other. The eventual perforation of the vessel wall, therefore, is up to a certain date more commonly the result of the separation of a slough of primarily devitalized tissue than due to the extension of a process of ulceration from without.

One or two special features may be emphasized in connexion with secondary haemorrhage from gunshot wounds. It may, of course, occur from any large vessel, or in old toxaemic or septicaemic subjects it may be of the parenchymatous variety. Given this generalization, however, we find that certain vessels are much more commonly the source of bleeding than others. The localization is determined by the degree of fixation of the vessel and the firmness of the bed upon which it lies. Thus the circumflex branches of the axillary artery, the subscapular or posterior scapular vessels in proximity to the scapula, the gluteal artery, the articular branches of the popliteal artery, the circumflex branches of the profunda femoris, the femoral artery in the lower part of Hunter's canal, and the anterior tibial artery as it lies on the interosseous membrane, are all common sites, and, it may be also remarked, troublesome ones in which to deal comfortably with the injured vessel. Another peculiarity is the comparative frequency with which large trunks in mobile positions, such as Scarpa's triangle, may escape damage by displacement and lie exposed on the surface of a large open wound. Such vessels may not infrequently have suffered contusion with consequent thrombosis.

As to the general treatment of these injured vessels, little new has been evolved; direct local ligature, prolonged forcipressure, or at the last extremity local plugging, are still the means on which the surgeon must depend. On rare occasions, as an emergency measure, a proximal ligature may be applied, but this is rarely successful and often harmful. A single exception to this rule must be allowed in the case of uncontrollable haemorrhage from wounds of the gluteal region; here in several instances ligature of either the internal iliac artery or its posterior trunk has proved a successful measure.

The proper method of treatment of an exposed arterial trunk, whether thrombosed or not, has opened up a question upon which the civil surgeon rarely has to form a decision. It may be broadly stated that the line of treatment depends mainly upon the degree of septicity of the wound of the surrounding soft parts. If the arterial coats are not seriously damaged and the wound be in a condition likely to respond to antiseptic treatment, an expectant attitude should be assumed if the vessel be pervious. If, on the other hand, the artery is thrombosed, the right course is to place ligatures both above and below the obliterated portion of the vessel, because such arterial thrombi in any case result in permanent occlusion, while in many instances the vessel may give way at the limits of the clot, a solid cylinder, like a pencil, coming away with great risk of haemorrhage; beyond this the clot provides a possible source of a peripheral embolus.

As to the general treatment of patients in whom a secondary haemorrhage has occurred, internal styptics such as calcium lactate have proved useless. This is easily intelligible in the case of the larger vessels, for in such a more or less rounded opening is usually present, the occlusion of which by a mural clot is of no more than very temporary use, while a local thrombus obstructing the whole lumen is unlikely to form. Even in cases of the parenchymatous variety internal remedies have proved useless.

The main advance in treatment has consisted in a return to the practice of transfusion of "whole blood," which has in great measure displaced the unsatisfactory saline infusion. For the popularization of this method we are mainly indebted to our Canadian colleagues in France. Several methods have been employed—the Kimpton tube, the Unger two-way stopcock, direct connexion of the radial artery of the donor with the vein of the recipient by a paraffin-coated rubber tube provided with silver cannulae at either end, the employment of a series of Record syringes, or the citrated method.

Papers have been written on this subject by E. Archibald,[2] L. Bruce Robertson,[3] A. Fullerton, G. Dreyer, and H. C. Bazett.[4] The number of cases published is not large; the latter authors include nineteen with eight recoveries. A large number of patients have, however, been treated over the whole army area, and a generally favourable opinion as to the results has been established. It must be remembered also that a very unpromising type of case has often been selected. Generally speaking, the good results have been obtained in cases of pure anaemia; when the anaemia has depended in part on haemorrhage, in part on septic infection, the procedure has not been satisfactory. Again, it has been more frequently successful as a measure in primary than in secondary haemorrhages.

Military conditions have allowed small opportunity for preliminary haemolytic tests applied to either donor or recipient, but, when practicable, a small preliminary transfusion of 10 c.cm. of the donor's blood has been made the day previous to the main procedure; accidents due to haemolytic reaction have not, however, been common. In one case, under the observation of the writer, the patient passed highly blood-stained urine for the succeeding thirty-six hours, but he recovered with no further bad symptom. In a few others alarming symptoms have passed off with no further result when the transfusion was discontinued, and two patients have probably died as a direct result of the treatment. Ill effects have not been sufficiently numerous, however, to raise the question of justifiability in the desperate cases for which the procedure is undertaken.

GAS GANGRENE.

This complication has been already dealt with, as it is met with in the field ambulances and casualty clearing stations. Naturally the most acute cases do not reach the hospitals on the lines of communication, and of late, coincidently with the development of the clearing station accommodation and the general acceleration of the transport of patients consequent on a shorter and quicker journey, fewer cases of the most serious nature arrive. None the less, the insidious manner in which the process starts, the rapidity with which it spreads, and the tendency which exists for delay in its development, all tend to maintain a constant supply of cases to the general hospitals.

Some early conceptions of the disease have undergone considerable modification; thus it was assumed, in consequence of the frequency with which the limbs are attacked and the fact that extension from the limbs to the trunk is commonly confined to the subcutaneous tissues, that the trunk itself was seldom primarily affected. More extensive observation has shown the fallacy of that assumption, and it is now well known that the contents of the cranial cavity, the pleurae, the pericardium, the peritoneum, the retroperitoneal tissue, and the muscular planes of the trunk are all attacked with varying degrees of frequency. The implication of the great body cavities, however, offers some special features; thus the infection is usually primarily of effused blood or blood clot, and in consequence of the resistance of freshly effused blood to the growth of the organisms, the exacerbation of symptoms is, as a rule, retarded for several days, or even a longer period. The symptoms in such cases offer a remarkable resemblance to those of a sudden internal secondary haemorrhage, a fact that in early days sometimes led to confusion.

Another question which is at present undetermined is the relative frequency with which patients die from a pure toxaemia, or of an actual septicaemia. The number of instances in which organisms have been observed in or cultured from the blood is relatively few, a remarkable fact considering the rapidity with which the entire vascular system is invaded after death. Certain observations, however, beyond those made upon the blood afford definite evidence that at an early stage a general infection is not uncommon. It was remarked at Boulogne in an early stage of the campaign that certain patients arriving with gaseous cellulitis of the limbs had at the same time local patches upon the trunk or arms at the sites of previous punctures for the injection of tetanus antitoxin, or even morphine injections; further, that similar phenomena might follow the introduction of a saline infusion. Again, cases were observed in which gas was voided with the urine, and in one of these a culture of *B. perfringens* was made from the urine. Further, a less striking occurrence, as the tendency of these infections to cause local thrombosis is well known, a certain proportion of the patients developed metastatic deposits in other parts of the body. It may be observed that one of the most common seats of these latter, the opposite buttock, is not always free from the suspicion of being a direct extension.

In other cases the rapidity of the process suggested a pure toxaemia, and some support to this view is found in the rapidity with which the limbs in some cases enlarge from a toxic oedema independently of the presence of gas. Major Rowland found that the filtered fluid from such cases caused general oedema and death in a few hours when injected into rabbits or guinea-pigs independently of the presence of any organisms, and was working on this subject at the time of his death.

The factors determining the mode and rapidity of extension of the process have also given rise to much interest. Certain facts appear to definitely favour the view that the process is a true cellulitis, although the frequency and extent to which the muscles suffer has led some observers to speak of the anaërobes giving rise to the condition as muscle feeders. It may be premised that the organisms concerned can establish no footing in the body in the absence of either dead tissue or some foreign body, and, this fact granted, it is obvious that the localization of the dead matter will correspond with the commencement of the process. Since the establishment of the fact by Major Curtis Webb,[5] that x-ray examination allows the determination of the presence of gas in the tissues, this method of examination has been widely employed as a means of diagnosis, and the examination of an entire limb by this method (Major Littler Jones) affords some striking information. If, for instance, the quadriceps muscle of the thigh has been wounded, the gas may invade the entire muscle, but the extension will be seen to follow the course of the great vascular cleft to the leg and even the foot, being localized, in the early stage at least, to the cellular tissue. Again, clinically, the extension of gas from the upper to the lower part of the thigh may sometimes be evidenced by a characteristic elongated swelling following the course of the vessels. Then, with regard to the intimate structure of the muscle itself, the separation of the individual fibres appears to indicate a similar process.

The rapidity with which the cellulitis spreads and destruction is caused appears to depend on the one hand on the tension in the special area affected, and possibly on the virulence of the organism or group of organisms concerned; on the other, on the degree of interference with the vascular supply either by the original damage or by subsequent thrombosis of the vessels concerned. Captain Bashford[6] has dealt with both these questions. The clinical observation of the rapid development of massive gangrene in a limb subsequently to the ligature of the main artery, or again the rapid death of that part of a long muscle cut off from its arterial supply, is common enough.

As to the actual organisms or combination of organisms responsible for the gangrene in its special forms, which may determine either the soft oedematous limb or the tight drum-like, or the emphysematous varieties, no definite knowledge exists. Captain Henry has furnished a short summary (printed at page 806) of the important series of observations carried out by himself[7] on the organisms concerned.

Another point of interest in this relation not cleared up is the absence of knowledge as to what determines the rapid haemolysis in one case accompanied by the development of more or less intense jaundice, while other patients present merely the appearance of extreme anaemia before death. Generally speaking, the anaemic patients are those that die most rapidly, and the difference may depend simply on time, since the characteristic brilliant orange-coloured discharge from the wound met with in mixed infections is rarely observed before the third or fourth day. The actual deficiency in the volume of blood in the cases of rapidly fatal issue is indicated by the low tension of the pulse as determined by palpation, and a loud knocking sound in the great arterial trunks, which gains the same intensity as it does in many patients dying from pure haemorrhage, and consequent fall in the diastolic pressure.

Such advance in methods of treatment as has been made rests entirely on the knowledge of the danger of leaving dead infected tissue or foreign bodies in the wound, and the necessity of relieving all tension in the structures affected; thus the knife is still our only aid. In making incisions for the relief of this form of cellulitis it may be remembered that size is of minor subsequent importance, provided the incisions are so planned as to avoid important structures and to allow of subsequent secondary closure. The latter is of special importance since the wounds infected by anaërobes often rapidly clean, and form some of the best for secondary closure at a comparatively early date.

Where amputation is indicated, the one principle to be adhered to consists in the maintenance of an open stump. It has been found that under these conditions, even where the amputation has been made through oedematous tissue, the latter drains freely and no further extension takes place. Beyond this, oedematous connective tissue, especially that of the green variety, is often found to be sterile, hence the inadvisability of interfering with it, particularly around the vessels and nerves, and thus opening up the planes of the limb to further infection.

Sir Almroth Wright,[8] in a paper on the conditions which govern the growth of the bacillus of gas gangrene in artificial culture media, in the blood fluids *in vitro*, and in the dead and living organism, has made the suggestion that intravenous injections of sodium bicarbonate may prove a means of combating the toxaemia, and gives short details of six patients treated by this method, of whom two survived. He assumes that in the treatment of the so-called "gas gangrene infections of man" he was dealing essentially with the same phenomena as those observed in certain laboratory experiments which showed that the bacillus of Welch, when grown *in vitro* in serum, diminishes the antitryptic power of the medium and renders it acid, thus converting the serum into a pre-eminently favourable medium for the growth of the bacillus. Experiments on the blood in the dead body showed that it is these chemical changes which furnish the conditions required for the avalanche-like progress of the bacterial infection. Finally, experiments on living animals showed a reduction in the alkalinity of the fluids taken from the focus of infection, and a reduction in that of the circulating blood—also an increase in the antitryptic power of the blood, combined with a diminished or abolished antitryptic power in the infected tissues.

In his investigations of the disease in human subjects he found the same high antitryptic response in the circulating blood and the reduced or abolished antitryptic power in the infected tissues or infected effusions, combined with diminished alkalinity of both tissues and effusions—thus, a local acidosis but also an acidaemia, the latter being found when an infection has culminated in "gas gangrene toxaemia."

TETANUS.

Tetanus, the terrible scourge which gave rise to so great anxiety in the autumn and early winter of 1914, has become a comparatively infrequent wound complication since the adoption of prophylactic injections of antitoxin in all cases of wounds and in cases of "trench foot" accompanied by vesication. Nevertheless cases still occur, in some instances because the primary injection has been given late as a result of the patients not being able to be "collected" from the zone of fire, a few men escape treatment as a consequence of the number of wounded needing to be dealt with after a serious engagement, and special idiosyncrasy may account for others. At an early date it was also recognized that the protective influence of the antitoxin is often exhausted at the end of eight or ten days; hence a general order was given to the effect that the injections should be repeated at intervals of seven days in all cases of serious wound and to patients whose wounds were not progressing well.

The cases met with include every degree and variety of the disease. Thus very acute cases with general spasms, slight cases in which trismus is the main feature, cases of "head tetanus," either of the paralytic class or with clonic spasms of the muscles of mastication, splanchnic tetanus, local tetanus of the limbs, sometimes remaining confined to the wounded member, in others becoming general, and cases of the so-called delayed class. In one remarkable instance of the last variety the patient, who had been sent to England in August with a small wound of the buttock, at the bottom of which was a small retained foreign body, returned to duty two months later. When on duty in the trenches stiffness of the corresponding limb, at first ascribed to sciatica, developed, and later general tetanic symptoms. Active treatment with antitoxin was followed by an uninterrupted recovery.

Accumulated experience has negatived the utility of treatment with carbolic acid or magnesium sulphate, both of which remedies were vaunted in the early stages of the campaign. Curative treatment by antitoxin is still upon its trial, and considerable differences of opinion exist both as to its utility and as to which route should be chosen for its exhibition. The subcutaneous route is generally considered unsatisfactory on account of the delay in conveyance of the antitoxin to the required area; hence, although generally chosen for prophylactic purposes, its use as a method of curative treatment is restricted to an auxiliary rôle. The intermuscular route has found more favour, although its efficacy is doubted by many. The intravenous route has not been shown to be specially efficacious, and as accidents of an anaphylactic character have followed its use it has been practically abandoned. The general applicability of the intrathecal route is still under discussion; the chief objection to its use lies in the large quantity of serum which requires to be introduced and the comparatively serious nature of the procedure itself if repeated injections are made. In some cases a definite disturbance of the intracranial pressure appears to result, and in some local inflammatory changes in the spinal theca have occurred. In spite of these objections the intrathecal method has been very largely employed, and a trial is now being made of a highly concentrated antitoxin.

The prognosis has depended in individual cases on the length of the incubation period, and, in spite of treatment, the mortality has remained above 70 per cent. of all cases treated. Symptomatic treatment by chloral and morphine, particularly the former, has retained its character both in the relief of suffering and as curative, in so far as it tends to delay exhaustion dependent on the spasms.

OTHER WOUND INFECTIONS.

Little new can be said regarding the remaining forms of wound infection, but it may be generally stated that the antiseptic solutions depending upon chlorine for their active element have proved the most successful application. One form of streptococcus infection deserves special mention as possibly corresponding to the variety of "classical hospital gangrene" described as the membranous. Cases of this nature have not been common, although sufficiently so to have become familiar. A wound which has previously been apparently progressing favourably becomes covered with a dense grey tough membrane, firmly adherent to the subjacent granulations. In the earliest stage this membrane does not materially differ from the thin layer of coagulated fibrin and included leucocytes which not uncommonly forms in cases of streptococcic infection which after a time fail to respond to treatment. The same cessation of free discharge from the wound surface is observed, a condition well described by Colonel Sir Almroth Wright as "lymph bound." The membrane then thickens so as to resemble one of the diphtheritic class; in fact strong suspicion was aroused in the earlier stages of the war that the change was due to a diphtheritic infection. Bacteriological examination has, however, in all cases resulted in the discovery of streptococci alone. With the development of the membrane a continuously increasing hard white oedema spreads up the limb or on to the trunk, the patient meanwhile suffering with pronounced signs of toxaemia. Incisions into the oedematous area give rise only to the escape of a small amount of serous discharge, and the tension wounds tend to dry up with little change. Amputation is usually followed by a recurrence of the same type of wound surface, and the patient dies in from four days to a week's time after the commencement of the process. No successful method of dealing with this special form of wound infection has been devised.

Septicaemia.

The most common form has been in connexion with streptococcal infections. It cannot be said that any advance has been made in the treatment of this condition. Encouraged by the results published by Messrs. Fraser and Bates[9] in dealing with some acute general infections, and the work of Lorrain Smith and his colleagues, a more or less extended trial has been made of intravenous injections of hypochlorous acid in the form of eusol, but no satisfactory results have been obtained. The same remark obtains to a more limited trial with colloid chloride of gold. The work of Dakin has shown that the antiseptic power of injections of eusol must be small in consequence of the minute amount of the antiseptic in proportion to the volume of the patient's blood. If either this solution or that of chloride of gold can effect any useful purpose, it is probably only by exciting as irritants a certain degree of activity in the endothelial lining of the blood vessels, and in neither case has this proved sufficient to serve the purpose aimed at of sterilizing the blood.

INJURIES TO THE GREAT VESSELS.

The dangerous nature of injuries to the great vascular trunks has been amply demonstrated by the fact that, except one or two injuries to the innominate vessels, the subclavian artery in the thoracic part of its course, and possibly a few iliac (although the writer has seen none of the latter amongst over 300 carefully examined cases of injuries to the larger arteries), injuries to the vessels of the trunk have been conspicuous by their absence on the lines of communication.

A considerable experience has been gained regarding the effects of contusion of the vessels, which has in the main substantiated the French pre-war experimental observations. At the same time, the occurrence of single simple linear fissures of the intima has been a more common form of lesion than one would have been led to expect. The chief importance of these lesions has been in connexion with secondary haemorrhage, to which allusion has already been made, and in the frequency with which the injury is followed by thrombosis. Several instances of subsequent embolism have been observed, this particularly in the case of the cervical vessels, where cerebral embolisms are readily detected as a consequence of the obvious signs with which blockage of the cerebral vessels is attended.[10] [11] This experience, combined with that of similar accidents occurring in connexion with actual wounds of the vessels, raises the question of how great a proportion of the instances of gangrene of the extremities following injuries to the vessels of the limbs, either spontaneous or following ligature, is due solely to the local occlusion of the main vessel. It seems likely, if all these cases could be thoroughly investigated, that embolism in the distal circulation plays a more important part than has hitherto been accorded to it, since several observations have been made of its occurrence.

The frequency with which various forms of missile have been employed has been followed by considerable change in the nature of the lesions, the highly contused lateral wound of the artery, and the clean perforation made by the modern bullet, have of late been less in evidence than extensive lateral lacerations and more or less limited lateral perforations caused by fragments of shells or minute fragments derived from bombs. Occlusion of wounds of the vessels by retained shell fragments, the removal of which has been followed by free haemorrhage, has not been rare. On the other hand, instances of missiles entering and travelling along the blood vessels has rarely been observed. The most striking instances have been those in which shrapnel balls have obtained entrance to the heart or large veins of the trunk and travelled downwards by gravitation. The most interesting feature of these cases, observed also in some wounds of the inferior vena cava, is the moderate degree of primary haemorrhage which had taken place.

Wounds of the great vessels arrive in the hospitals on the lines of communication usually some days after their infliction, but a considerable proportion may arrive at an earlier date in consequence of the absence of primary haemorrhage, or the coexistence of some more serious or more easily recognized injury having allowed them to be overlooked. This is especially the case in multiple bomb or shell injuries, where one out of twenty small wounds produced by as many fragments widely distributed over the whole body may have implicated an artery; or in the case of severe fractures of the long bones, accompanied by great swelling of the soft parts.

The result of this experience has been greatly to widen the scope of the stethoscope in the diagnosis of arterial injuries, since auscultation will often reveal the presence of the pathognomonic systolic bruit, when the absence of local pulsation in the swollen area and the presence of pulsation in the distal arterial circulation may, if depended upon alone, lead to a serious error in diagnosis. Further, it has been observed that the local vascular bruits may, in some third of the whole number of injuries to arteries of the lower extremity, and less frequently in other vessels, be conveyed to the cardiac area, and distant vascular lesions have in some cases been detected by the presence of the apparently cardiac murmur.[12] This phenomenon is observed both in pure arterial and arterio-venous injuries. It has also been observed that the distal blood pressure of the limb is materially lowered in the presence of a lateral arterial lesion—in fact, practically to the same degree as if the main vessel has been occluded.

As a consequence of the period at which arterial injuries reach the hospitals on the lines of communication the treatment has been for the most part expectant, the large majority of the patients being evacuated to the base in England. The importance of rest in allowing subsidence of the general circulatory excitement, and the consolidation of the aneurysmal tumour, has been obvious. It is also held that during this period the enlargement of the collateral circulation makes some progress. Some evidence in favour of this view is offered by the fact that the nutrition of the limb is not observed to suffer during this period, while wasting, sometimes of a rapid character, often follows the performance of necessary ligation.

Accidents during this probationary period have not been common: gangrene has been rare; secondary haemorrhage uncommon, unless the wounds were large and badly infected; and suppuration of the aneurysm has been an accident of extreme infrequency.

Active treatment has consisted in the main of ligature of the vessels. This has been indicated for extension of the blood effusion within the limb, secondary haemorrhage, signs of pressure on the trunk by increasing size and firmness of the false aneurysmal sac, or signs of inflammation. When the hospital accommodation has allowed a sufficiently long stay a certain number of cases have been operated upon in the absence of any untoward symptoms.

For purely arterial injuries, ligature of the vessel above and below the wounded spot has been the most common operation. In a number of these cases the main vein has been found to be thrombosed, but this accident has not had any adverse influence on the result. The same statement may be made as to the results observed when coexisting wound of the vein has made it obligatory to tie both vein and artery, or in the cases where the main vein had already suffered complete division and occlusion. The same experience has followed ligature of both artery and vein above and below the communicating channel in arterio-venous aneurysms or aneurysmal varices. Hence it has been claimed[13] that simultaneous occlusion of both artery and vein is a negligible occurrence with regard to any increase of risk to the vitality of the limb. Further, that insomuch as a better balance is maintained between the arterial and venous elements of the collateral circulation, and the blood pressure within the limb increased, the operation is preferable to that confined to the wounded artery alone.

In certain vessels—for example, common carotid, common femoral, popliteal—after ligature of which acute local anaemia and gangrene is specially liable to follow, a limited trial has been made of Tuffier's tubes to maintain temporarily the main current pending the increase of the collateral circulation. In a small series of eight cases (common carotid 1, axillary 1, femoral 2, popliteal 4) in which this method was used, in no instance did gangrene take place. In one femoral case, in which the tibial pulses were absent at the time of operation, feeble pulsation returned and persisted for a few hours, and in the second the foot, which had been cold, at once became warmer and remained so. Such evidence as has been obtained, however, does not suggest that the maintenance of the main current persisted more than a few hours, and the clots expressed from the tubes when removed on the fourth day, although firm in comparison with the terminal projecting into the proximal end of the vessel, did not suggest a very gradual formation. Moreover, in one of the popliteal cases, in which it would have been difficult to place a ligature on the lower end of the artery, it was not found necessary to do so, as the vessel was closed by a firm thrombus. Such experience as has been gained is, however, definitely in favour of a more extended trial of this method.

Suture of the vessels, either end-to-end or lateral, has been employed only in few cases. At the period during which the patients are still in the hospitals on the lines of communication the vessels are still comparatively fixed and difficult to free without damage to the coats, as well as rigid in themselves; hence, if sutures are introduced, the tension upon them is far greater than is the case with normal arteries. Again, a large proportion of the wounds are too extensive for anything but an end-to-end union after removal of the damaged extremities of the vessel, and here again both local tension and an undesirable temporary flexion of the limb to reduce it are opposed to successful suture. Cases, however, do occur in which either form of operation can be carried out. In a small series of six operations the following immediate results were obtained:—Brachial 3: (*a*) Lateral suture, lumen of vessel reduced more than one-third; no radial pulse before operation, but it returned four days after. (*b*) Refreshment of ends and end-to-end suture. Radial pulse palpable after operation and persisted. At the end of the third week the distal blood pressure in the limb had risen by 22 mm. of mercury. (*c*) Excision and end-to-end suture. Radial pulse absent during first two days after operation, then returned. Five days after the operation the distal blood pressure was 30 mm. of mercury greater than before. Popliteal 1: Lateral suture. A good anterior tibial pulse was present the day after operation, but the posterior tibial was absent. Femoral 2: (*a*) Lateral suture of an arterio-venous communication of six months' standing. Distal tibial pulses present at the end of the operation and persisted. (*b*) Lateral suture in Hunter's canal. Tibial pulses absent before operation, but were just palpable four days later. Distal blood pressure still 50 mm. of mercury lower than in other limb.

Time and a considerably more extended observation is needed to determine whether the operation of suture does attain very much better results than simple ligature. The above results, including no sort of accident, seem to do little more than prove that the operation is practicable and not dangerous in selected cases. That a patent lumen is preserved in the vessels in the majority of cases is, however, not yet proved.

In a case of large wound of the thigh, in which the foot was cold and no tibial pulses were palpable, the femoral artery was discovered to be thrombosed 2 in. above the apex of Scarpa's triangle and no pulse could be felt in Hunter's canal. Captain Cowell made an incision one-third of an inch long into the vessel and squeezed out a small decolorized thrombus and a red clot 3 in. in length from the vessel distal to the incision. The vessel was then sutured, and pulsation returned in Hunter's canal but was not palpable at the ankle. A secondary thrombus again formed and obstructed the vessel. It appears probable that if the intima has been sufficiently injured to cause a primary thrombus to develop, operations of this class are not very likely to succeed; still a repetition is probably worthy of trial.

FRACTURES.

At an early stage in the campaign, when wounded men were streaming in large numbers into the improvised hospitals in Boulogne, it became evident that neither the regulation outfit of splints nor the supply of emergency splints manufactured by the mechanics attached to each hospital unit sufficed to cope with the large number of fractures admitted. An opportune paper by Lieutenant-Colonel Robert Jones which appeared about this moment[14] moreover impressed all those concerned in the treatment of these injuries with the enormous advantages offered by splints of the H. O. Thomas class for military use, both in facilitating the early and safe transport of patients, and in allowing efficient extension of the limbs to be continuously maintained. Further, a number of modifications of the type of splints which have subsequently proved of much value were quickly in demand. In order to meet the requirements thus suddenly arising, application was made to the Medical Director-General at the War Office for the supply of a skilled surgical mechanician to undertake the control of a central splint manufactory at Boulogne. Mr. Salmon was sent out, and since that time an enormous number of splints have been manufactured locally, and supplied not only to the general hospitals on the lines of communication, but also to advanced units throughout the army. It would be difficult to overestimate the practical value of this establishment.

The first question which has arisen in connexion with these injuries is the relative importance of the primary treatment of the wound of the soft parts, or the adjustment of the bony fragments themselves. Cases may occur in which either assumes the first place—thus the limb may be threatened by anaërobic infection; reduction of the displacement and maintenance of the bone in position may prove a matter of extreme difficulty as a result of the position and direction of the fracture; or the presence of multiple wounds in inconvenient positions may render it impossible to apply such apparatus as will maintain sufficient extension. Under any of these circumstances treatment of the wounded soft parts may claim priority, but as a general rule the principle of prompt reduction of the displacement and maintenance of extension has been adhered to. It has been recognized that secondary efforts at reduction when a septic wound has cleaned and settled down is a serious operation involving risks of lighting up again a condition which has been with difficulty overcome.

The next question which arises is whether rigid extension in the direct long axis of the limb is to be maintained or the joints placed in the flexed position. For patients treated in France the former method has been the more widely adopted, in order to utilize the facilities in transport which the Thomas's splints undoubtedly offer. As an invariable custom, however, this practice has not been able to be followed, as many surgeons have not been able to obtain good position of the fragments in such positions as the upper and lower thirds of the femur. To meet this difficulty the Thomas's splints have been bent or other methods employed. For instance, Hodgen's splint for the upper third of the thigh bone, or a swinging frame of the same dimensions of the bed, the feet being fixed by plaster extension strips to the angles of the lower end, and the head and body lowered (Major Sinclair). For the lower third the wire double-inclined plane of Hey Groves has occasionally been employed. All these methods, however, require additional attention and longer stay in France, hence they have not been widely resorted to.

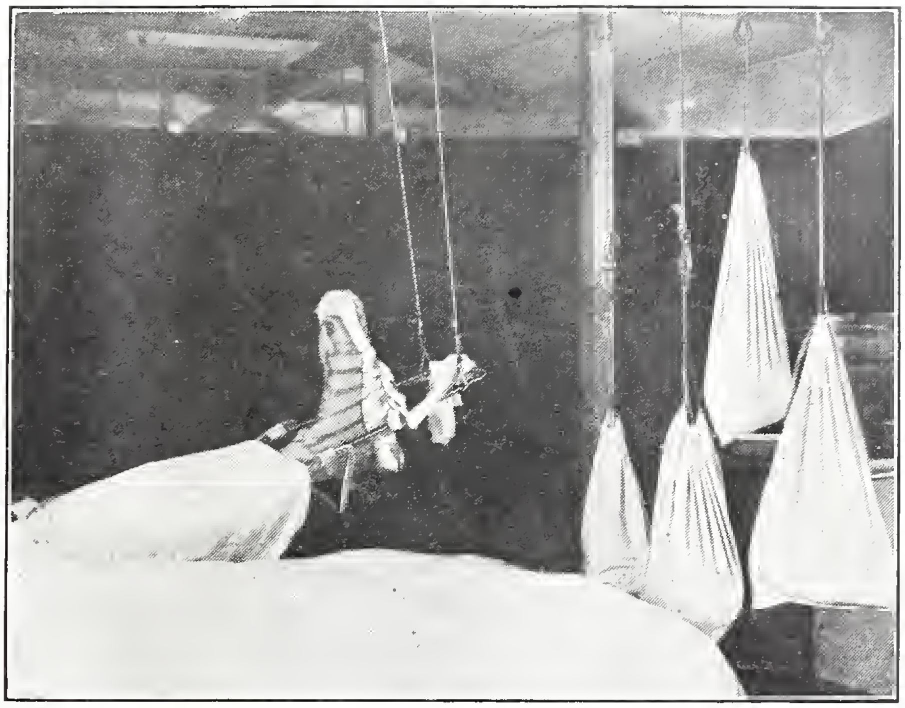

FIG. 2.—The Thomas Splint with Foot Extension, Suspended (Major Sinclair). The foot extension is applied by means of $\frac{3}{4}$ in. strips of flannel bandage, each strip being threaded through two metal triangles. One set of six triangles is aligned along the inner margin, another set of six along the outer margin of the sole. The flannel strips are glued to the sole, sides and dorsum of the foot, care being taken that the ends do not meet over the dorsum. Cotton-wool is dabbed over the glued area to hasten and strengthen the setting. Whilst the glue is drying the Thomas splint is applied in the usual way and fitted with a support to keep heel clear of the bed. The triangles are now threaded with tapes, which are passed over the serrated edges of the special wooden foot-piece and tied. This foot-piece rides on the side bars of the Thomas splint. The foot, now being secured to the foot-piece, is commanded absolutely. It can be flexed, extended, inverted or everted, rotated in or out, lowered or raised. At the same time extension can be applied to the whole limb by tapes attached to the cross-bar of the foot-piece and fixed in the V of the Thomas. Having got length and alignment in the fractured limb, the cross-bar is fixed by tying to the side bars with tape. This is often the only form of extension which can be applied in fractures of both bones of the leg near the ankle. Care should be taken to thoroughly fix the knee in the splint by means of large cotton-wool pads and a bandage. The whole splint is suspended in a C-model suspension.

The method of maintaining extension has also been a question much discussed, and fixed extension by a stirrup attached to the end of the Thomas's splints has been commonly adopted. Yet in a large number of cases weight and pulley extension has been preferred and is sometimes necessary. The question, in fact, has not been settled in favour of either of the opposing parties.

A third method, that of a continuous screw, has also been considerably employed, both in conjunction with the type of Thomas's splint with a spat attachment, in the Wallace-Maybury modification of the Thomas, and also in the bent Thomas's splints and their modifications for treating fractures of the humerus with the elbow flexed.

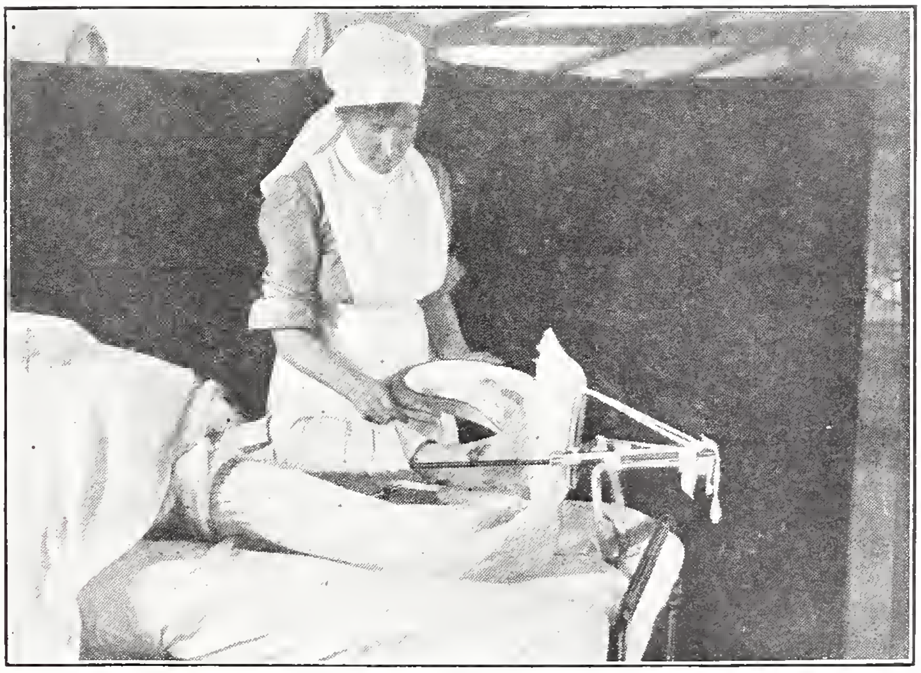

FIG 3.—Thomas Knee Splint with Plantar Extension (Major Sinclair). A plaster cast is made of the sole of the foot by means of flannel impregnated with plaster-of-Paris. Incorporated in this cast are tapes. When the cast is dry it is glued to the sole of the foot and extension is got by attaching it with the tapes over the serrated border of a special wooden foot-piece.

The use of the pin transfixing either the lower end of the femur, or the upper extremity of the tibia, for the attachment of extension apparatus in cases of fracture of the femur, has found little favour in France. This has perhaps mainly depended on unwillingness to make a fresh wound in a limb already the seat of a septic wound; but beyond this, the fact that practically all patients need to be transported at an earlier date than would be convenient for removal of the pin renders the method undesirable.

One great feature in the wards, and an incalculable blessing to the patients and attendants, has been the wide adoption of the overhead rail for the suspension of limbs, and to take the place also of the pulley arranged over the head of the patient's bed in most hospitals to allow him to lift himself by his arms. This was devised at an early date in Boulogne as a result of seeing patients with fractured thigh put up by the so-called Balkan method by Lieut.-Colonel Miles. It has consequently acquired the name of the Balkan support. Two of them, one placed on either side of the bed, may also be employed for the support of an entire hammock bed.

For fixation of the thigh in the abducted position, the abduction frame of Robert Jones was ready to hand, but in the case of the upper extremity much difficulty was experienced in the earlier part of the campaign until the capability of a short Thomas's knee splint for this purpose was fully appreciated.

Captain Page has adopted the ambulatory method of treatment in some cases of fracture of the thigh and the leg, the former with the aid of lateral extending screws fixed above and below to plaster collars surrounding the thigh, the latter by muslin strips impregnated with plaster-of-Paris, after Delbet's method.[15]

A great amount of ingenuity has been expended on splints devised to facilitate transport or to meet special emergencies, also on various adjuncts to the splints themselves. Thus many varieties of rubber, metal, or flannel slings to support the limbs in wire splints, extension attachments, forms of glue for fixing extension strips to the limbs, and lastly, the highly efficient counterpoise suspension apparatuses of Major Sinclair (Figs. 2, 3, 4, 5). Space does not allow of more than mention of these many adjuncts to convenience, cleanliness, and the comfort of the patients.

Plaster-of-Paris has on the whole been but little used, and mostly for purposes of transport. The difficulty of keeping plaster splints clean has mainly militated against them.

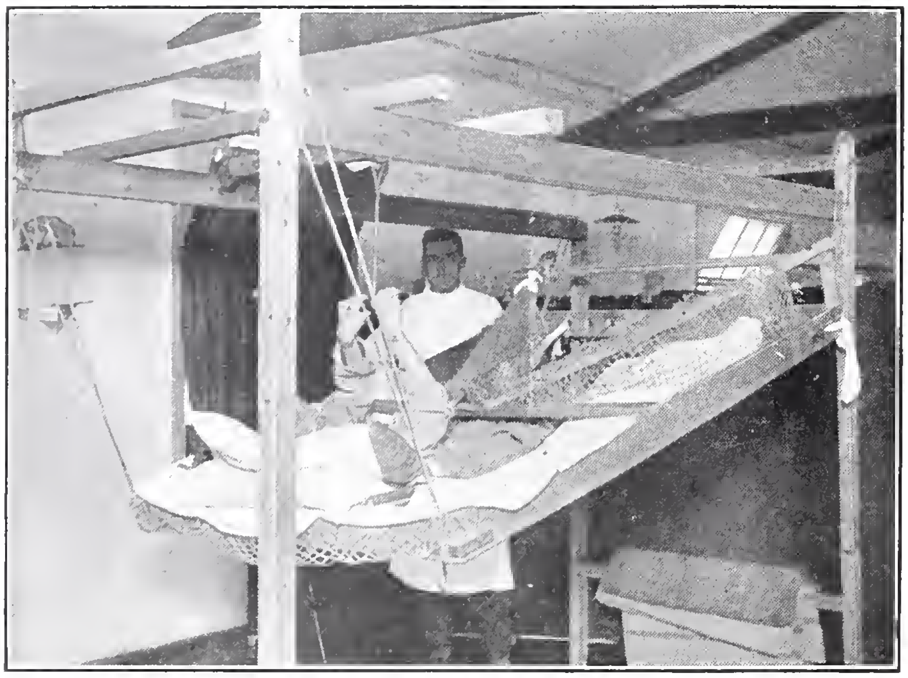

FIG. 4.—The Net Frame used in the Treatment of Fractures of Upper Third of Femur with or without Large Wounds (Major Sinclair). An ingenious combination of the hammock with abduction of the thigh, embodying the principle of Hodgen's thigh splint. A wooden frame 7 ft. by 5 ft. is constructed with a transverse bar, which is at the level of the patient's umbilicus; two leg bars run from the umbilical bar to the foot of the frame. Extensions are applied to both legs by means of gauze and glue. These are passed through holes at the end of the frame and tied. The patient's back and legs are well padded, and the body and legs are supported in the frame by strong one-inch netting. This netting is in three pieces—one for the body, fixed to the sides and head of the frame, and two leg pieces fixed to the leg bars, which are abducted to the necessary angle. Either can be freed independently. The frame is slung by the corners to four uprights (the universal leg suspension frame). Extension is obtained by lowering the head of the frame, usually about 15 inches. This method of treatment is efficient, and the results very satisfactory, both dressing of wounds and nursing of patient being extremely simple.

Lastly, as to the treatment of the wounds. In this place it is assumed that proper cleansing, drainage, and removal of loose fragments and foreign bodies has been carried out at the casualty clearing stations. Under these circumstances no further immediate procedures are needed on the lines of communication. Even in the case of inefficient drainage or extending infection great judgement requires to be exercised in interference on the first arrival of the patient.

The object to be aimed at is the secondary closure of the wound at the earliest date practicable, and with this object a continuous antiseptic method should be carried on. Up to the present time the most conspicuous success in this direction has been attained with the Carrel-Dakin method, and if treatment has been commenced at the casualty clearing station, the wound may in a considerable proportion of all cases be closed within a period of three weeks. It may be fairly hoped, in the light of present experience, that the number of chronic suppurating compound fractures will be in the near future largely reduced.

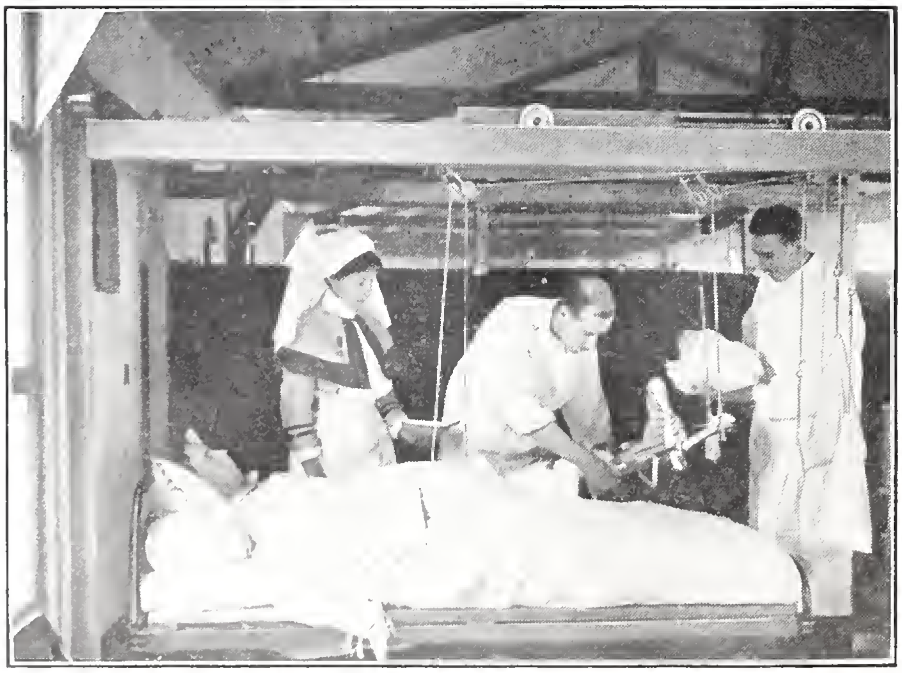

FIG. 5.—Fracture of the Thigh treated with Thomas's Knee-splint and Sinclair's Foot Extension; Counterpoise Suspension from a Travelling Gallery (Sinclair).

The date at which sequestra should be removed to allow a complete surgical sterilization of the wound has raised some discussion. When the fracture has not been accompanied by sufficient loss of bone for risk of non-union to occur, there can be no doubt that the earliest possible date is desirable. If, on the other hand, little but the periosteum and a few fragments remain, the probability of securing a sufficiently active osteogenesis to effect union is no doubt increased by leaving apparently dead fragments of bone in connexion with the periosteum for some time, because a few bone cells may have escaped to help in repair which will probably perish if exposed in a suppurating wound.

In suppurating fractures of some standing Rutherford Morison's method of secondary closure after introduction of the iodoform, bismuth, and paraffin compound has been imported from England, and is giving good results.

Radical treatment for the condition of chronic osteomyelitis has not often been undertaken, unless the cases are of such a character as to be subjected to amputation; the majority are transferred to England, where prolonged stay in hospital is more readily assured.

Lastly, methods of mechanical fixation by plates and screws or by wiring have been very little resorted to as primary measures. A very large proportion of the cases so treated failed from the septic character of the wound, but in the face of the results more recently obtained by secondary sterilization and closure of the wound it is probable that these methods may be revived in cases of difficulty of maintaining the fragments in position, or at any rate resorted to at a much earlier date under more favourable conditions.

Both in Boulogne and elsewhere special departments have been established for the treatment of fractures alone, and in the hospitals generally an attempt has been made to collect the patients with fractures under the charge of one medical officer. This plan has obvious advantages in ensuring special aptitude on the part of the surgeons concerned and the possibility of attaining general results approaching the ideal. At the same time, its general adoption is impracticable; the cases are of a nature to necessitate a long stay in hospital, their collection in one ward imposes a very heavy task on the nursing staff, which needs to be largely increased, and, finally, it not only removes a source of great interest from the general surgeon, but it also renders him less fit to treat such cases when heavy fighting produces them in such great numbers as to render segregation impossible. It must always be borne in mind that the good military medical officer is a general practitioner, since occasions must always occur with frequency in which he must be prepared to deal efficiently with any kind of casualty. The only way to carry out usefully this idea is to create one or two special centres in which such cases can be treated as well as possible by specially skilled surgeons, and utilize these as presenting an ideal towards which all should work. Such special hospitals, no doubt, encourage the device of new methods and the perfection or modification of others; our special hospitals have done this, but it is only just to the medical officers generally to say that a number of the most useful devices have been introduced quite independently of special conditions, and it is fair to assume that with young and energetic officers this is always likely to be the case.

WOUNDS OF THE JOINTS.

The experience gained in recent previous wars regarding the treatment of wounds of the joints has proved of small avail in the present campaign, because it was obtained almost entirely from observation of the lesions produced by rifle bullets, which had proved themselves of minor gravity and capable of healing spontaneously with good results when subjected to simple treatment founded on the sovereign principle of rest.

The problem of dealing with grossly infected joints, often enclosing a septic irregular fragment of shell and dirty clothing, perhaps further complicated by extensive fractures of the cancellous articular extremities of the bones, was therefore practically a new one to the surgeons engaged. Some definite facts have emerged from the first flood of difficulties encountered, and these may be shortly summarized as follows:

1. The wound of the soft parts clothing the joint is vastly more difficult to deal with than the articular cavity itself, and demands the most scrupulous care on the part of the surgeon.
2. The synovial capsule itself is capable of dealing unaided with an infection often of a really serious grade.
3. A strong tendency exists for an infection to localize itself, and the remaining portion of the capsule may remain free.
4. Drainage in the sense of the insertion of large tubes left in position for days or more is not only useless but also harmful.
5. That a gunshot wound of a joint cannot be dealt with too early, and with proper treatment forms one of the best subject wounds for primary suture.
6. That following the primary surgical intervention the main principle to be observed is that of complete rest gained by immobilization and extension.

General appreciation of these facts has resulted in the conclusion that a large majority of the joint injuries should be subjected to their chief active surgical procedure in the hospitals of the advanced lines, and hence the general hospitals at the present time receive only cases well upon the road to recovery, or such as present the more difficult problem of dealing with established infection and suppuration.

The line of treatment which has been adopted in the former class of case has been already laid down elsewhere (June 2nd, p. 718); it only remains to add that even cases which eventually do excellently often arrive on the lines of communication with synovial effusion and local redness over the joint and in the neighbourhood of the closed wound, signs due entirely to an exacerbation consequent on the disturbance inseparable from transport down the lines. Such cases usually settle down rapidly if only strict care be taken to maintain complete immobilization, while any premature intervention may be the direct cause of disaster.

The class of case may be first dealt with in which a patient arrives with a foreign body still occupying the joint cavity. This may be the result of the impracticability of early x-ray examination, the nature of or the small size of the foreign body, or of a large number of patients having to be rapidly dealt with.

If the foreign body be a rifle bullet, and the condition of the external wound satisfactory, no immediate action beyond fixation of the joint is advisable at this period. It is far safer to leave the bullet *in situ* until all chances of awakening or spreading an infection have passed by. The same attitude of masterly inactivity is to be recommended in instances in which the included foreign body consists of very small fragments of shells or bombs, especially if the bodies lie without the actual confines of the articulating surfaces. Such foreign bodies may never need removal. Thirdly, when fragments of shell are of larger size and need removal they may be found to have rebounded from the surface of the bone and actually lie without the confines of the joint cavity, although the capsule has been wounded. Special care needs to be exercised in dealing with these cases, since portions of clothing carried before them by the shell fragments may still occupy the joint cavity. Lastly, the foreign body may be impacted more or less deeply in the articular end of the bone, and if a shell fragment it should be removed, although in a patient who has recently undergone transport undue haste in the procedure is not advisable.

Wounded joints which arrive with obvious local and general inflammatory signs need to be treated with great judgement. The condition may have been aggravated by transport and may rapidly improve when complete rest is assured. Again, the serious infection may be situated in the periarticular structures rather than in the joint itself. Precipitate action under these circumstances is to be deprecated. The safer plan is to place the limb at rest for twenty-four hours or longer, and observe the result, meanwhile making a puncture and withdrawing fluid, if present, for bacteriological examination. If want of improvement or the result of the bacteriological examination indicate the advisability of intervention, the type operation should be of the nature advocated by Colonel Gray—excision of the wound or wounds in the joint coverings, flushing of the synovial cavity after evacuation of its contents, and suture of the synovial membrane. The treatment of the external wound differs according to its size and condition. In some instances it may be closed completely, in others a drainage tube may be inserted down to the sutured capsule, or, where the wound is extensive or obviously not free from infection, it is better to leave it freely open and treat it by antiseptic measures until surgically sterile and suitable for secondary suture. Naturally some of the more extensive wounds must be left to heal by granulation.

The treatment of a freely suppurating joint requires to be of a different character; here the joint cavity must be maintained open and sterilization effected by an antiseptic method, of which Carrel's has undoubtedly given the best results. When, for instance, the cavity of the knee-joint in general needs to be drained, the method carried out by Captain Campbell and advocated by Captain Gill is worthy of special mention. It is generally agreed by all observers that when suppuration extends backwards from the knee the line of progress is not from the pouches lying on either side of the crucial ligaments but around the lateral aspects of the condyles—in point of fact, by the popliteus extension of the capsule on the outer side and the semimembranosus extension on the inner. Hence posterior drainage from the centre of the joint is not only inconvenient to arrange but also inadequate to meet the requirements. Postero-lateral incisions have therefore been devised, but Campbell and Gill have regularized a method which simplifies greatly the accurate and adequate drainage of these regions. Lateral incisions having been made corresponding in position with the reflection of the synovial membrane from the femur, a pair of artery forceps is pushed down on the outer and inner aspects of the lower end of the femur respectively until the points of the forceps can be palpated in the popliteal space. An incision is then made down on to the guide thus furnished, and a direct route is established to the two bursal extensions from the posterior aspect of the joint, and by this Carrel's tubes are conducted for the requisite depth. Should still freer drainage be required, the incision is enlarged, the respective heads of the gastrocnemius exposed, and a portion of the origins of the muscle excised, so that a free opening is ensured. Further mention of the treatment of the extensions by the subcrureal pouch, the internal intermuscular septum, beneath the popliteus or along the semimembranosus tendon is unnecessary. The upper pouch of the joint may need several instillation tubes, which are gradually decreased in number and totally removed at as early a date as possible.

For suppurating joints of some standing Rutherford Morison's method has been adopted with success.

The influence of a coexisting fracture on the prognosis in a joint injury is a matter of great moment in any class of case, but the frequency with which this condition is met with in gunshot wounds invests it with a very special degree of importance.

There is little doubt that the actual risks to the safety of the limb attached to this complication were somewhat over-estimated at the commencement of the war, and that to-day, in the presence of a more satisfactory and rational treatment of the wound, and also the knowledge acquired as to the possibility of saving the joint entire, or submitting it to either primary, intermediate, or secondary excision, the prospects of avoiding amputation are much improved.

It may be laid down generally that tunnels, cavities containing missiles, fissures, and even T fractures, do not of necessity entail a very serious prognostic gravity provided the wound in the soft parts can be and is satisfactorily dealt with, and the fragment of shell removed.

In a large proportion of such injuries a more or less movable joint can be attained, and in many a perfect result. Still, in no form of injury does this more depend upon the continuous attention of the surgeon, care in the initial treatment of the joint, and subsequent daily precaution. Injuries affecting both bony elements are more serious, but may be treated by excision. Severely comminuted articular ends commonly need amputation, except where the single articular end can be removed, as in the case of the upper ends of the humerus and femur, or where bones, such as the carpal and tarsal, can be completely removed. The position to-day may be fairly summed up by the remark that, putting on one side articular injuries in which the bony destruction is irreparable, the fate of the case depends upon the success with which the wound of the soft parts surrounding the articulation is treated, the actual joint lesion taking a place of secondary importance.

EXCISION OF JOINTS FOR GUNSHOT INJURY.

The operation of excision is certainly struggling for a return to its former position as a procedure in military surgery. The operations were no doubt in older wars often performed for what would now be considered injuries not sufficiently extensive to demand so radical a procedure; further wound treatment was often defective. Yet excision occupied a prominent place until, with the introduction of the bullet of small calibre and ogival or dome-shaped tip, injuries of the joints began to be regarded as of minor importance. A revulsion in the latter opinion occurred early in this campaign, and some surgeons, notably Colonel H. M. W. Gray [16] and Colonel A. Fullerton,[17] have striven to enlarge the sphere of application of the operation. Growing experience has shown that it may be resorted to in well chosen cases in all three stages of the progress of a joint injury, with a distinct prospect of success under suitable conditions.

Early Excision.

By this is meant immediate operation at the casualty clearing station. It is obvious that a certain number of joints may be excised as an alternative to amputation. Thus a severe localized comminution of the lower end of the femur or the upper end of the tibia may render any chance of recovery with a useful limb improbable, while the uninjured shaft may still be of sufficient length to allow of ultimate union. The same remark may apply when both articular surfaces have been destroyed by a traversing missile. In the case of the upper end of the humerus, and also of the femur, comminuted fractures with destruction of the articular surface also form good subjects for the operation. In the case of the elbow a partial excision may often be done. The possibility of these procedures is limited, however, by the definite condition that circumstances will allow the patient to remain a sufficiently long time to be able to bear safely the risks of transport down the lines of communication to the general hospital.

Intermediate Excision.

This operation is that concerning which the gravest doubts were felt in the earlier stages of the war, and even now it can only be undertaken with the definite intention of following it at once by an amputation if the procedure is followed by local extension of infection and signs of systemic absorption. It has, however, proved that excision may be a successful alternative when the severity of the general and local signs seems to indicate amputation as the only resource. The explanation of this experience can be found solely in the facts that better drainage can be ensured when the articular ends of the bones have been removed, and the wound can be treated more effectively. It is a striking fact that progressive osteomyelitis from the sawn ends of the bone has not developed, especially when the frequency of this complication in ill-drained comminuted fractures is remembered. Two special details need mention: (1) Should the synovial membrane be removed? As a general rule this question is to be answered in the negative. The synovial surface in itself is better capable of dealing with an infection than a freshly cut layer of subsynovial areolar tissue; further, when no extensions of suppuration have taken place it forms an effective barrier against such extensions when proper drainage is provided. (2) Should the refreshed ends of the bones be placed in apposition, or be temporarily kept widely separated by extension? The latter plan has been most generally adopted. The excision of bone should be of the most limited extent in the case of the knee. Lastly, in this joint as in all others, excision is not to be regarded as a proper alternative where efficient drainage can be expected to ensure the end desired.

Late Excision.

The principles guiding the performance of excision at a later date do not materially differ from those laid down above; moreover, as far as the hospitals on the lines of communication are concerned, the distinction is rather one of date than of the actual pathological conditions to be dealt with.

THE RESULTS OBTAINED IN WOUNDS OF THE KNEE-JOINT.

Any writer concerned with wounds of the articulations instinctively thinks of the knee-joint, the most troublesome to treat, and that in which a good result is most gratifying. Two small series of cases treated by Captain Campbell and Captain Gill respectively may give some indication of the results being attained.

In 60 consecutive cases (Campbell) coming from the fighting on the Somme, 14 were classified as very severe, 17 as severe, 13 as slight, and 16 as having retained foreign bodies. Three died and one required amputation. The three deaths were due in two cases to secondary haemorrhage and in one to septicaemia. The other 56 cases were transferred to England in good condition, the great majority with every prospect of good movable joints.

In a second series of 69 cases (Gill), in 31 the injury was inflicted by a bullet, and in all an uninterrupted recovery was obtained by rest alone.

Amongst the remaining 38 cases one died as a result of meningitis following a fracture of the skull, and in four cases, one of which developed delayed tetanus and recovered, amputation was required.

Thus in 129 cases amputation was required in 3.87 per cent., and death occurred in 3.1 per cent.

A much larger series of cases, treated by different surgeons at Rouen, has been analysed by Colonel Gilbert Barling, and the results are shown in the appended table:

Cases of Wound of Knee-joint operated on at Rouen Hospitals in the second half of 1916, excluding all those which were so quiet that nothing was done, and all those submitted to early amputation as conservative measures were inapplicable.

1.	Total cases of injury to knee operated on	845
2.	With bone injury	438
3.	Without bone injury	407
4.	Wound excised and closed	322
5.	Cases with wounds excised and closed requiring further operation	82=25.5%
6.	Wound excised and packed	336
7.	Cases with wounds excised and packed requiring further operation	128=38.4%
8.	Excision of knee	42
9.	Arthrectomy, partial or complete ...	15
10.	Excisions or arthrectomies amputated...	13=22.8%
11.	Deaths after excision or arthrectomy ...	13=22.8%
12.	Amputation without excision	151
13.	Deaths after amputation without excision	49=32.4%
14.	Total amputations	164=19.4%
15.	Total mortality	72= 8.5%

Note.—One hospital with a large number of cases was unable to separate the cases under headings 4 and 6.

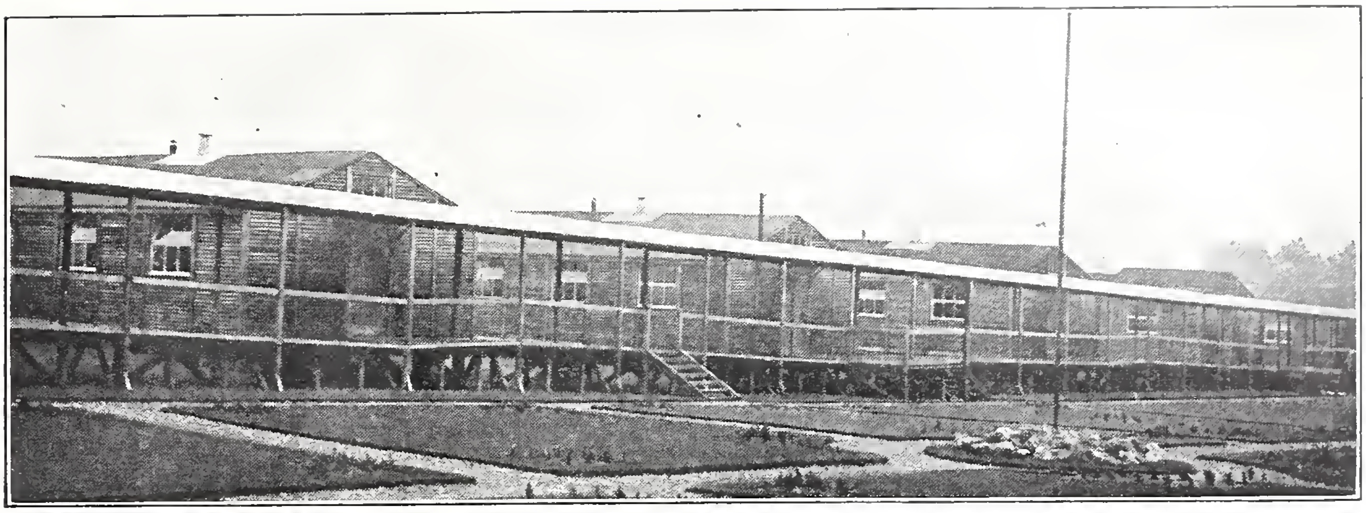

Fig. 6.—View of St. John Ambulance Brigade Hospital, showing connexion of the huts by an open corridor.

INJURIES TO THE HEAD.

A great change has taken place since the commencement of the war both in the nature of the cases and in their actual number. This change depends on the one hand on the fact that a larger number of these injuries are retained and operated upon at the front lines, and on the other on the protection afforded to the head by the helmet. The early treatment of these injuries has already been dealt with; it suffices here to say that the patients which now arrive have either already been operated upon and are in good condition, or they come down already suffering from septic complications. The general lines governing the treatment of the latter class of case have been admirably laid down in a paper in the *British Journal of Surgery* by Sargent and Holmes,[18] and certain points in the technique of the operative procedure elaborated. These authors have also dealt with the anatomical and histological changes associated with traumatic injuries and infected wounds of the brain and their bearing on the surgical treatment of these conditions. Further, examination of a considerable number of patients some months after their return to England proved much more satisfactory than had been generally expected. It was found that the proportion of patients who die after transference to England is small; later complications, such as cerebral abscess, are comparatively rare, and serious sequelae, such as insanity and epilepsy, are much less common than had been foretold. In only 15 per cent. of the patients examined, however, had more than one year elapsed from the date of the injury. It also appeared that many patients with foreign bodies deeply lodged in the brain recover, and are scarcely more liable to serious complications than men in whom the brain has been merely exposed and lacerated. These conclusions are obviously only tentative, but as far as they go appear hopeful.

Holmes and Sargent[19] have also described a condition hitherto rarely seen, and established a definite symptom-syndrome for its recognition. It is characterized by an immediate spastic paralysis of the legs, and frequently associated with spastic paresis of the proximal segments of the upper limbs; they have shown it to be due to occlusion of the superior longitudinal sinus or of the veins that enter it, by a depressed fracture of the vertex of the skull. Experience showed the results of surgical interference with cases of this class to have been extremely unsatisfactory. Thus, among 39 cases observed which were operated upon either by the authors or others, 15 deaths occurred, while among 37 cases in which no operation was undertaken only one died before transference to England. While it is allowed that these figures have no absolute value, as naturally only the most serious cases were selected for operation, and in seven of the fatal cases direct injury to the brain was present in addition, yet the results emphasized the danger of operation. Moreover, the uncomplicated cases showed a remarkable tendency to improve, probably owing to the free venous anastomosis permitting a re-establishment of the circulation.

An important contribution to the localization of function in the brain has been published by Lister and Holmes,[20] who from a study of a large number of cases with injury in the occipital region were able to determine the relative positions in the cortical visual areas of the foci that subserve vision of separate portions of the visual fields. They bring forward strong evidence with regard to the site for the centre for macular or direct central vision, of which very little had been previously known.

The following conclusions are come to:

1. The upper half of each retina is represented in the dorsal, and the lower in the ventral, part of each visual area.
2. The centre for macular or central vision lies in the posterior extremities of the visual areas, probably on the margins and the lateral surfaces of the occipital poles.
3. That portion of each upper quadrant of the retina in the immediate neighbourhood of, and including the adjacent part of, the fovea centralis is represented in the upper and posterior part of the visual area in the hemisphere of the same side, and vice versa.
4. The centre for vision subserved by the periphery of the retinae is probably situated in the anterior end of the visual area, and the serial concentric zones of the retina from the macula to the periphery are probably represented in this order from behind forwards in the visual area.

Holmes and Smith have recorded observations on the nature and localization of motor apraxia, or the inability to perform purposeful actions despite the preservation of movement and power, and in disturbance of the faculty of localizing objects in the external world by vision.

Probably in no other branch of medicine have so many and such difficult problems arisen as in the treatment of wounds and diseases of the nervous system. Further, in this field an extraordinary opportunity has occurred to observe, analyse, and record the effects of local lesions, many of which are rarely, if ever, seen in civil life. When the results of this work are eventually correlated, they must throw much light on the physiology and the symptoms of disturbance of different parts of the brain, spinal cord, and peripheral nerves, and thus increase our knowledge of the diagnosis and treatment of nervous diseases. Special arrangements have been made in order that cases under early observation in France should be sent to special hospitals in England, so that continuous records will be maintained of a very large number of patients.

Note by Colonel Percy Sargent.

I am indebted to Colonel Sargent for the following summary of his opinions:

The very large experience gained of gunshot wounds of the head has led to a considerable degree of modification in their treatment. Immediate routine operation, often incomplete and, in the absence of full neurological information and x-ray examination, sometimes unnecessary and even misdirected, is no longer widely practised. It has long since been made abundantly clear that early evacuation of operated cases is often followed by disaster. As it is impossible to operate upon these cases and to retain them at the clearing stations for a period which renders transportation safe, more especially during times of great military activity, the practice now generally adopted is to transfer them without operation as soon as possible to hospitals further down the line. It has been made quite clear that surgical intervention is rarely required for the relief of cerebral symptoms, whether general or focal. Its chief aim is the prevention of intradural infection. On this conception all cases of gunshot wounds of the head fall into one of two categories, according to whether the dura mater has or has not been penetrated. Non-penetrating wounds have a low rate of mortality, whether operated upon or not, provided that the surgeon respects the integrity of the dura mater.

Fig. 7.—Interior of a ward of the St. John Ambulance Brigade Hospital.

It is customary, therefore, to do in these cases only as much as may seem advisable to ensure speedy healing, such as excision of the edges of the wound, removal where necessary of bony fragments, and partial or complete closure of the gap in the scalp either by suture or by some form of plastic operation.

Penetrating wounds, on the other hand, afford more room for difference of opinion regarding their treatment. Individual cases continue to present difficulties even to those who have seen large numbers, but, broadly speaking, there is a consensus of opinion in favour of the following line of treatment: The wounds having been cleansed and dressed, the patient is transferred as soon as possible to a hospital where he can be retained for at least a fortnight after the operation. A complete neurological and radiographic examination is made and the operative treatment then directed according to the diagnosis thus arrived at. In some cases of penetrating wounds no operation is indicated, such as those in which a bullet has passed completely through the head; or those in which a bullet or a metallic fragment is embedded in the brain at a distance from a small clean entrance wound, and is giving rise to no symptoms. Another class of case for which operative interference is usually contra-indicated is that in which the longitudinal sinus has been injured. Cases where a track from the scalp wound leads down to indriven bony fragments, or to an easily accessible missile are operated upon, briefly, as follows: A moderately large flap is turned down after resection of all damaged tissue round the scalp wound: the bony opening is enlarged sufficiently to expose thoroughly the opening in the dura mater; the indriven fragments of bone and metal are removed under a constant stream of hot physiological saline solution; and the track is drained by a celluloid, metal, or rubber tube brought out through the original wound. In cases of more superficial cerebral laceration, where track drainage is unnecessary, the principle is employed of covering the denuded brain by some plastic operation on the scalp; in these circumstances drainage tubes emerging from the angles of the scalp flap are usually employed for a few days.

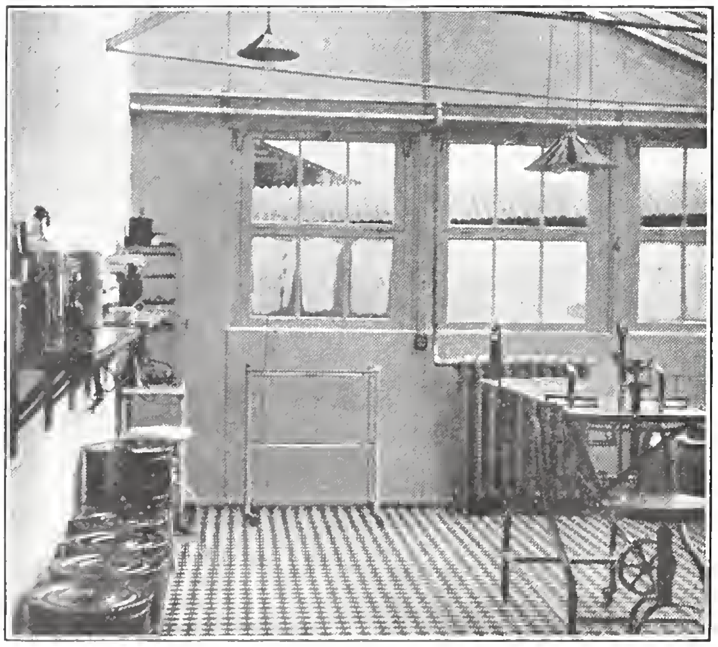

Fig. 8.—Interior of the operating theatre of the St. John Ambulance Brigade Hospital.

Retained Missiles.

Opinions still vary regarding the advisability of operating for the removal of bullets or shell fragments. There is much evidence to show that these foreign bodies are well retained, and, apart from the uncommon accident of late suppuration, cause no symptoms. It has been stated by more than one writer that bullets embedded in the brain move about under the influence of gravity. The evidence for this view is wholly unconvincing. Removal of bullets, even when the wounds have healed and the risk of septic infection thereby is largely minimized, must be, even in skilled hands, attended by an amount of damage which in most cases would have more serious neurological consequences than could the presence of an aseptic bullet.

Primary removal of a deeply-seated missile carries with it the additional risk of septic infection. For these reasons the usual practice is to leave alone such missiles.

The treatment of indriven fragments of bone is more debateable. When driven into the brain by a missile which is itself retained, the bony fragments are rarely, if ever, more deeply placed than the projectile. When driven in by the impact of a missile which does not itself enter the cranial cavity, the bony fragments are rarely found so deeply situated but that they can be removed along the track with little, if any, additional damage being done.

With regard to the septicity of these indriven metallic and bony fragments, it has been found that a large proportion, when dropped into culture media immediately upon removal, fail to provoke any bacterial growth, either aërobically or anaërobically.

The question of the intracranial pressure has been the subject of repeated observation. Among the conclusions of practical importance which have been arrived at are the following:

1. Apart from the rare instances of extensive intracranial haemorrhage, traumatic oedema, whilst playing an important part in symptomatology, does not reach a sufficient degree of intensity to endanger life.

2. The instances of severe intracranial haemorrhage not rapidly fatal are very few; and even amongst these there is a certain number which surgical intervention is not likely to save. Experience has shown that an intracranial haemorrhage which is sufficiently severe to demand operative relief, and which can be recovered from, gives unmistakable signs of its progress. The operation can be deliberately planned and carried out with the definite object in view. Exploratory operations on the chance of discovering a haemorrhage are rarely if ever called for.

3. In case of intracranial pressure from secondary oedema which is causing severe headache and herniation of brain, this can almost always be controlled by lumbar puncture. Occasionally contralateral decompression has been done for these cases and has afforded good results.

Such evidence as is at present available from the later results (six months to two years) is all in support of the general policy of treatment outlined above.

The steel helmets have played an important part. The study of cranial wounds before and after their general adoption brings to light many interesting points. The outstanding feature, however, is that which concerns the penetration of the dura mater. The proportion of penetrating wounds has very largely diminished, as also has the mortality, another amongst many indications that the surgeon cannot attach too much importance to the integrity of this membrane, or treat it with too much respect.

INJURIES TO THE SPINAL CORD.

Wounds and injuries of the spinal cord, when amenable to treatment, demand early surgical intervention. At the commencement of this war but little was known regarding the actual structural changes attendant on gunshot injuries, and what was known was concerned mainly with the changes which were found in spinal cords examined at a comparatively late date. The position of the surgeon was rendered yet the more difficult, in that past clinical experience had shown the extreme difficulty which exists in forming a correct prognosis, particularly in view of the remarkable ultimate recoveries observed in patients whose primary symptoms had not been able to be distinguished from those observed as attending total destructive lesions.

In order, therefore, to recognize when surgical intervention can be undertaken with a reasonable prospect of success, it was necessary to obtain an accurate idea of the nature of the pathological changes produced in the cord by modern projectiles. An investigation on this subject was undertaken by Gordon Holmes.[21] He found that even slight local injuries are very frequently associated with extensive oedema, haemorrhages, softenings, and often with ascending cavity formation, which may extend a considerable distance both above and below the level of the original injury or wound. These changes he refers to the concussion effect produced by the missile through the walls of the spinal canal; they may exist even without the presence of a fracture of the vertebrae. Such changes can obviously not be relieved by any reasonable operation, and the fact that, apart from the secondary cavities that develop later, they occur immediately or within a very short time of the infliction of the injury, diminishes the favourable prospect of any surgical intervention. In some cases undoubtedly the symptoms are largely or in part due to compression of the spinal cord by either the missile or a fragment of depressed bone, but numerous examinations have proved that even in these the same intraspinal lesions exist.

Even relatively slight injuries often produce for the first few days, the period when operation offers the best chance of success, symptoms that may be confused with those of total and irreparable damage to the cord, and some clinical indication of the severity of the spinal injury is consequently necessary before an operation can be reasonably undertaken. This question was investigated in a large number of cases and the conclusions were published in the same lectures. These are to the effect that the safest guide to the severity of the injury is afforded by the form and character of the sensory disturbances, and especially by the changes and modifications in the reflexes of the affected limbs.

In most cases the site of the wound or a radiographic examination permits an accurate diagnosis of the medullary lesion, but not infrequently this can be determined only by a study of the symptoms produced by it. The method by which an accurate local diagnosis can be made is also dealt with in these lectures. Here, too, many important and interesting symptoms which result from injuries to different portions of the spinal cord are described. It was found, for example, that when its lower cervical and the upper thoracic segments were severely affected, the patients often presented a serious symptom-syndrome characterized by hypothermia, bradycardia, low blood pressure, reduced secretion of urine, and mental hebetude. The body temperature may fall as low as 80° F. (27° C.), the pulse-rate to 35 or 40 per minute, the blood pressure to 60 mm. of mercury, and only 4 to 8 oz. of urine may be secreted in the twenty-four hours.

Injuries to the region from which the vasomotor fibres to the kidneys pass off may, on the other hand, produce an extraordinary polyuria, and lesions in the higher cervical segments were shown to be often associated with hyperpyrexia.

Attention has been drawn by T. R. Elliott[22] to the occurrence of spinal lesions in men who have been exposed to shell explosions in their immediate vicinity, but who escaped direct injuries.

The acquisition of wider knowledge has not, however, greatly widened the scope of operative intervention. Operations are still for the most part confined (1) to cases in which a radiographic or direct examination reveals the presence of displaced and depressed fragments of bone or the lodgement of foreign bodies either within the canal or buried in the cord (it may be mentioned that several cases have been observed where retained bullets have travelled long distances within the spinal canal, particularly in its lower part); (2) to cases in which the patients suffer severe and unbearable pain; (3) to cases in which pressure from haemorrhage around the cord is suspected, such cases being very rare. An additional class may be added in which a late operation is performed on the chance of some improvement being gained, mainly as a question of expediency. Patients with injuries to the nerves of the cauda equina have as a rule been evacuated to England.

No striking change in operative technique has been developed, beyond the general tendency to partial rather than classical laminectomies, and perhaps the development of an increased confidence in the utility of placing a muscle graft over the opening in the spinal membranes when leakage of cerebro-spinal fluid has been associated with the performance of the operation. An intact dura has throughout been an important immediate prognostic element, as in the case of injuries to the head.

Early drainage of the bladder by a suprapubic tube has been advocated by Percy Sargent since the commencement of the campaign, but the difficulties in the transport of patients thus operated upon, and the increased responsibility devolving on the nurse in keeping the back in good condition, have militated against an extensive adoption of this measure.

Injuries to the peripheral nerves have been extremely common; it has indeed been estimated that in 18 to 20 per cent. of all limb wounds slight or more serious lesions of the large nerve trunks coexist. But owing to the facts that when, as is usually the case, extensive septic wounds are present, the early surgical treatment of nerve injuries is impracticable, and that the patients with small and clean wounds can be safely transferred to England, neither the treatment nor the study of these injuries has been an urgent question in the general hospitals on the lines of communication in France.

ABDOMINAL INJURIES.

The chief interest in injuries to the abdomen has rightly been transferred from the general hospitals to special hospitals at an advanced line or to the highly developed casualty clearing stations. Prior to the summer of 1915, however, the great majority of injuries to the abdominal viscera were dealt with on the expectant system, and such of the patients as survived arrived in the general hospitals. The experience gained from the observation of these afforded some information regarding the prognosis of wounds of both hollow and solid viscera, which may in the future not be so readily obtained.

The enormous mortality attending injuries to the small intestine was clearly demonstrated, both by the comparatively small number of patients arriving, and by the simple nature of the injuries found at *post-mortem* examination compared with the extensive and multiple character of the lesions which have been almost uniformly discovered by early operations. This experience exerted a healthy influence in supporting the advisability of early operation. The lesser fatality attending wounds of the colon, excluding the transverse colon and the sigmoid flexure, was also clearly brought out, since a larger proportion of wounds of the large gut arrived at the general hospitals, and of these more than 50 per cent. recovered sufficiently to be transferred to England in good condition. This number obviously has no bearing on the actual mortality of wounds of the colon, but compared with a percentage recovery of less than 16 per cent. in a small series of minor injuries to the small intestine, it is sufficiently striking.

A few points of some interest also emerged from the series of *post-mortem* examinations made on patients who had survived several days; thus the general character of the peritonitis in cases of wounds of the small intestine, and the localized nature of that developing in consequence of wounds of the large intestine; the observation that when the wound track traversed the psoas muscle and its sheath, extravasation of faecal contents extended to the thigh, and, indeed, might travel the whole length of the lower limb; that, while patients dying from the effects of wounds of the small intestine uniformly succumbed to peritoneal infection, deaths following wounds of the colon were, in 40 per cent. of all the cases, the result of a general infection from the septic wound of the soft parts of the trunk, and not from the peritoneum itself, the main feature of the general infection being a purulent bronchitis; lastly, in a series of *post-mortem* examinations made by Captain Henry, in every case a general *post-mortem* invasion of the blood stream by anaërobic organisms was discovered.

Experience again proved the practical futility of performing operations for the closure of intestinal wounds after thirty six hours has elapsed from the time of injury, and it is probable that any successes obtained in this field can be counted upon the fingers. On the other hand, the good results often obtained by performing a proximal colostomy in large wounds involving the colon, and thus preventing the occurrence of the late systemic infection referred to above, have been amply proved. The few cases in which an attempt has been made to obtain the same result by making an intestinal short circuit by anastomosis have not been encouraging, and it is obvious that this class of case is not a favourable one for such procedure, both by reason of the general condition of the patient and the difficulty in performing a clean operation.

No novel features have been disclosed by observation of the numerous instances of wounds to the solid abdominal viscera, except that perhaps more attention has been given to interference with their secretory activity, and that the favourable course commonly following these injuries in the absence of serious septic complications has tended to confirm the propriety of maintaining an expectant attitude in the question of surgical intervention. Speaking generally, it may be said that the formation of an abscess or the occurrence of secondary haemorrhage are the only indications for interference at the period at which the patients reach the general hospitals. Septic infection has been the common cause of death in all cases of fatal injury to the solid viscera, and in 40 per cent. of deaths from wounds of the liver secondary haemorrhage has accounted for the fatal issue.

Intraperitoneal injuries to the urinary bladder, even discovered during operation, have been rare throughout the campaign, and for some reason probably connected with the conditions of trench warfare extraperitoneal wounds have become far less often seen than in the earlier stages of the war. These latter cases were the source of much interest because they were sometimes difficult to diagnose from injury to the pelvic small intestine in the early stage, and also because treatment by simple suprapubic cystostomy was found so successful. Of thirty such consecutive operations only two proved unsuccessful, and in each of these comminuted fractures of the pelvis were coexistent. If treated expectantly, in many instances the urine escaped freely from apertures in the abdominal wall, the buttock, or the thigh for a week or ten days, and the patients appeared to be doing well, when infection of the urine took place, extended to the bladder, and toxaemia followed. Even in the latter class of case, however, a late operation may save the patient.

The condition of cases arriving at the general hospitals subsequently to the primary operations at the advanced lines deserves a word of mention, although the patients are for the most part birds of passage.

The general results have been remarkably good, the most common defect, now not so common as in the earlier stages of the adoption of early operation, has been incomplete union of the wound in the abdominal wall. In some cases this has been accounted for by a primary use of the initial entry or exit aperture for the site of the exploratory incision, in others from the persistency of a gap left for a drainage tube; but beyond these complicating factors an obvious difficulty has been experienced in obtaining firm primary union. In some cases this may have depended on an actual deficiency in vitality of the patient, but in the majority it has undoubtedly been due to infection, and when it is borne in mind that these operations are performed on the subjects of intestinal perforations in whom infected blood is present and has to be evacuated from the abdominal cavity, it is not to be surprised at. Such wounds have usually healed readily by granulation. The next occasional trouble has been the secondary formation of abscesses or fistulae. These have not been common, the abscesses usually following colic wounds and the fistulae wounds of the small intestine. It is noteworthy that fistulae have formed secondarily in several cases in which the primary exploration has been negative—a fact bearing on the common occurrence of severe contusion of the wall of the intestine unaccompanied by perforation. As a rule, the bowels have acted regularly and well; in some instances diarrhoea has been troublesome, and the writer has only seen one patient in whom secondary obstruction was caused by adhesions. On the whole, the evidence seems against troublesome peritoneal adhesions developing with any degree of frequency. In one *post-mortem* examination made upon a patient who died from pneumonia the abdominal cavity was absolutely free from adhesions, and an end-to-end anastomosis was so perfect as to be with difficulty discovered. As is usually the case, however, the bowel on the proximal side of the line of union was already somewhat dilated.

RADIOGRAPHY.*

Considerable advance in the localization of foreign bodies has been made in the general hospitals on the lines of communication during the progress of the campaign.

While the majority of surgeons are agreed that the greatest radiographic assistance which they receive in the removal of foreign bodies is afforded either by stereoscopic skiagrams, or else by two plates taken at planes at right angles to one another—usually antero-posterior and lateral—there are situations in the body, such as the thorax, abdomen, and hip region, where it is more convenient to be provided with the depth of the foreign body in centimetres under a certain spot.

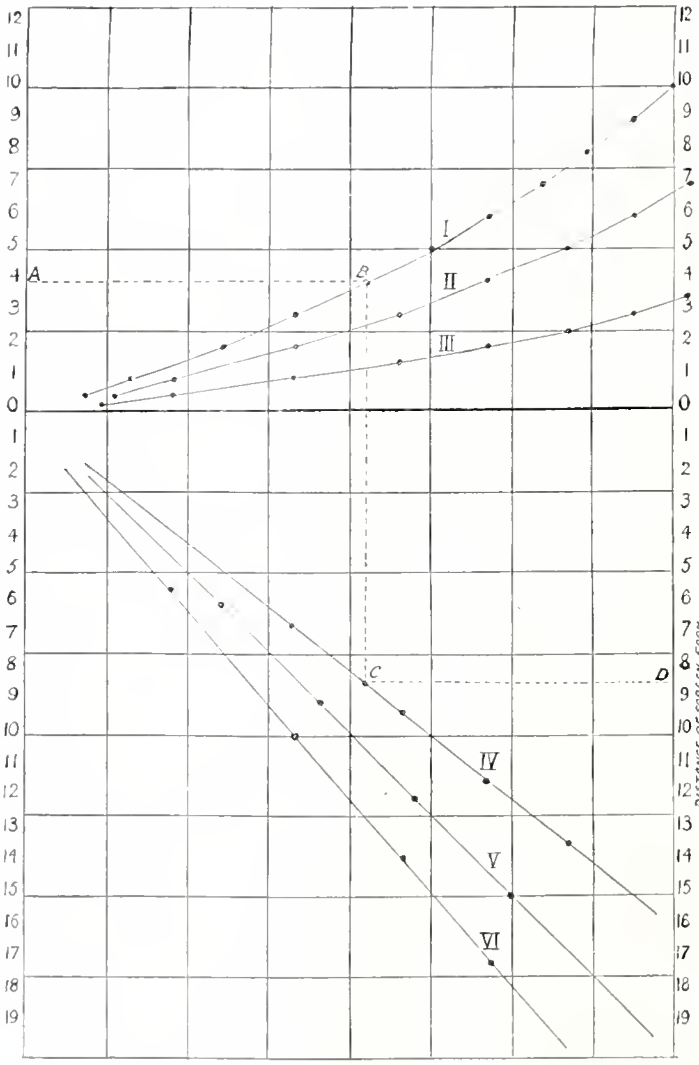

FIG. 9.—I, Curve for a displacement of the focus of 150 mm. II, Curve for a displacement of the focus of 100 mm. III, Curve for a displacement of the focus of 50 mm. IV, Correction for a distance from the screen to the focus of 400 mm. V, Correction for a distance from the screen to the focus of 500 mm. VI, Correction for a distance from the screen to the focus of 600 mm.

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* The writer is indebted to Major Curtis Webb for the technical details contained in this section.

The prime credit of evolving a method for estimating the position of a foreign body must be accorded to Mackenzie Davidson, but in the early days of the war Dr. Hampson worked out a modification of Davidson's principle whereby the depth of the foreign body from the screen or plate could be easily and quickly determined, and several ingenious modifications of a mechanical device attached to a fluorescent screen have been put upon the market based in principle on Hampson's work.

In October, 1914, M. Paul Wigny, director of the Rouen Electric Light Company, worked out a formula and chart (Fig. 9) for Major Curtis Webb; subsequently the formula was independently evolved, and published in England in 1915. This formula is based on Hampson's principle, and has been extensively utilized by Major Curtis Webb, who has supplied the following details as to its application:

In Figure 10 T is the table, and P the part of the patient in which lies the foreign body at an unknown depth (x); L = the distance between the anticathode and plate;

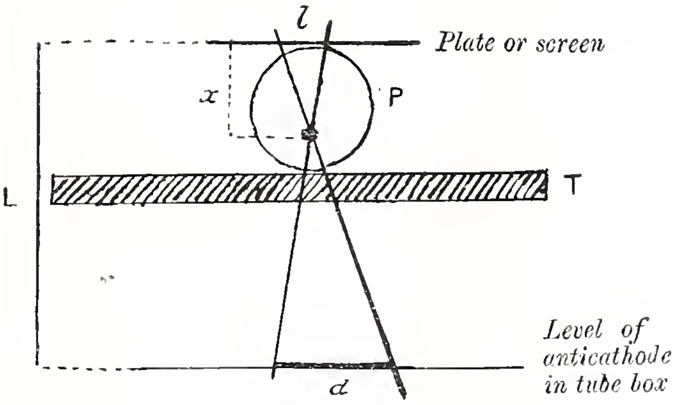

Fig. 10.

d = the horizontal movement of the tube between the two exposures; l = the distance between the two shadows on the plate or screen. With these indications it is easy to work out the formula:

$$x = \frac{l \times L}{d + l}$$

The procedure is as follows: First centre the tube under the part where the foreign body is seen, and close the diaphragm down until the foreign body is just enclosed by the aperture. Mark the skin over the point, and the foreign body will lie vertically under it. Place a plate in position with its centre about over the foreign body, move the tube a few centimetres (4 or 5) one way, expose and then move the tube back 10 centimetres, and expose again *on the same plate*. On developing, there will be two shadows: the distance in centimetres between two corresponding points of the shadows will be the distance l; d should be 10 cm., and L should be 50 cm. On many x-ray couches there are arrangements for securing this last factor, and where this is the case the chart (Fig. 9) will enable the exact depth of the foreign body to be ascertained without calculation in the following way:

In the upper left side of the chart are a series of numbers corresponding to the distance between the shadows. Take this figure, follow the horizontal line until it touches the curve corresponding to the amount of lateral movement of the plate—usually 10 cm. Then follow the perpendicular from there until it impinges on the line corresponding to the distance between the plate and the anticathode (L), and then trace the horizontal from this point towards the right of the chart. The example in the chart is indicated by the line A B C D, where a distance between shadows of 4 cm., a movement of the tube of 15 cm., and 40 cm. between plate and anticathode corresponds to a depth of the foreign body of 8.5 cm.

If a couch has been extemporized the distance of the anticathode from the top of the couch can be measured once and for all and noted, and the distance of the plate, where lying on the part under examination, from the top of the table can be added to the above known distance and the depth of the foreign body finally worked out from the formula; or the part can be raised on pillows until L is approximately 50 cm. From a surgical point of view approximation is all that is necessary, for note that, if it be endeavoured to arrange that L be 50 cm., but for some reason it be either 48 or 52 cm., then x will be either 8 or $8\frac{2}{3}$. Should, for example, l be taken as 2 cm., then a difference of $\frac{2}{3}$ cm. is negligible in an ordinary removal of a foreign body. However, very little ingenuity is required to ensure L being fairly accurately 50 cm.

For localization of foreign bodies in the eye, an excellent head rest has been devised by Major Higham Cooper, which is both simple, rapid, accurate, and convenient.

In civil practice it has been customary to radiograph the eye with the patient in the sitting position. This is impracticable in the majority of wounded soldiers, hence the head rest, illustrated in Fig. 11, was designed to enable men to be x-rayed while in bed in the wards.

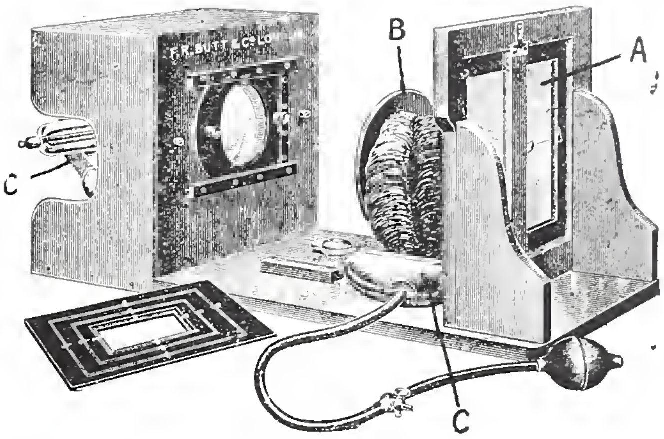

Fig 11.

The apparatus is either arranged across the bed, or made to replace the pillow, the patient's head being placed in the position shown in Fig. 11, pressed against a plate-holder A, provided with cross wires. The patient's head rests upon an air pillow, which can be inflated to raise it to the height desired. An upright of thin wood, B, is then pushed up to the other side of the head, and clamped to immobilize the head. The x-ray tube (previously centred on the intersection of the cross wires on the plate-holder) is held in a clamp, c, capable of a 3 cm. shift to either side of the central position against stops. Hence no measurements require to be made, as both the distance of the tube and the displacements are fixed.

In localizing foreign bodies in the eye a metal marker must be placed in some known relation to the centre of the cornea. In head injuries the markers may be placed as desired. Localization is done by the graphic method for vertical and horizontal position, and the usual formula is employed to calculate depth. The negatives possess also the advantage of being stereoscopic.

For working out the *exact* position from a pair of stereoscopic plates a most excellent and accurate method has recently been published which dispenses with the Mackenzie Davidson localizer.

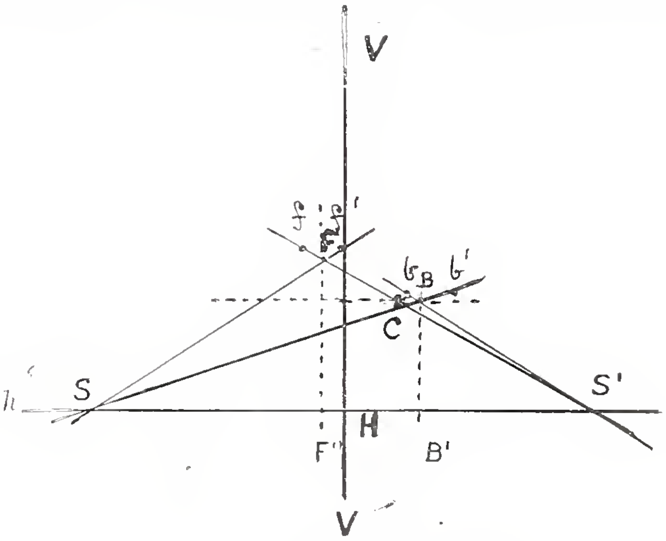

Fig. 12.

A typical case will make this clear (Fig. 12). In this case the tip of the fuse wire was exactly 9 mm. under and on the same plane as the centre of the pupil when the

Name.. *Date*..

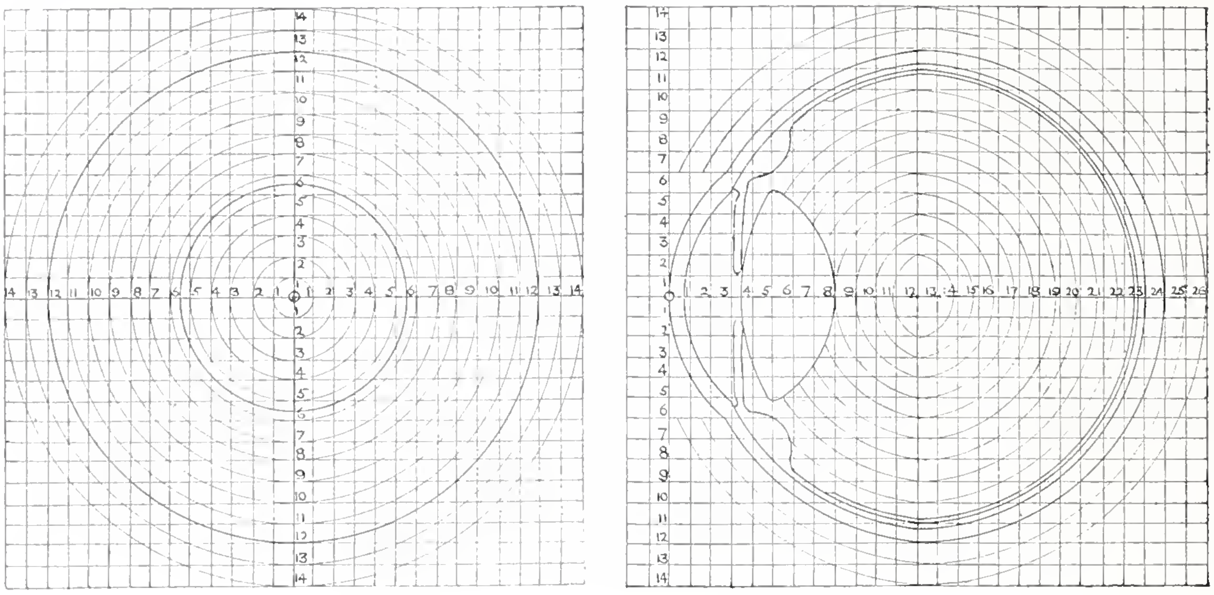

FIG. 13.—Plot out the foreign body on the left diagram, and read off its distance in mm. from the Central Corneal Axis (C.C.A.). Imagine the right diagram rotated round the line of the C.C.A. to the plane passing through the foreign body. The number of mm. the foreign body is from the C.C.A. is counted in the plane tangential to the centre of the anterior surface of the cornea, and the foreign body is plotted out at the appropriate depth. It will be seen whether the foreign body is inside or outside the globe, and how many mm. it is internal or external to the outer surface of the sclerotic.

The foreign body is ......mm. $\left\{\begin{matrix}\text{above}\\ \text{below}\end{matrix}\right.$ the central corneal axis.

......mm. to the $\left\{\begin{matrix}\text{nasal}\\ \text{temporal}\end{matrix}\right.$ side of the central corneal axis.

......mm. deep to the plane tangential to the centre of the anterior surface of the cornea.

The charts show the foreign body to be $\left\{\begin{matrix}\text{inside}\\ \text{outside}\end{matrix}\right.$ the globe......mm. $\left\{\begin{matrix}\text{internal}\\ \text{external}\end{matrix}\right.$ to the outer surface of the sclerotic.

patient looked at some distant object with the sound eye, the patient lying on his back so that the horizontal line *h h* may be considered as passing from the vertex towards the chin. Obviously, then, the vertical line, V V, will be parallel to the central corneal axis (C.C.A.).

Now, on either side of the point of intersection H measure two distances, H S, H S′, each of 3 cm., then the points S and S′ will correspond to the respective positions of the anticathode of the tubes at the two exposures, and *f* and *f′* the shadows of the tip of the fuse wire, and *b* and *b′* the shadows of the foreign body, and F and B will be the respective true positions of the tip of the fuse wire and of the foreign body. From F and B drop two verticals F F′ and B B′; measure F F′ and B B′, then F F′ minus B B′ will be the depth of the foreign body. Again, draw a horizontal line through B parallel to *h h*, and as it is known that F was 9 mm. below the central corneal axis, then the centre of the pupil is indicated by the point C; then the distance C B will be the distance of the foreign body *above* or *below* (in this case above) C.C.A. Finally, knowing the distance of the anticathode from the plate, we can determine the distance of the tip of the fuse wire F from the plate—using the formula

$$x = \frac{b \times L}{d + l}$$

—by the distance between the shadows *f* and *f′*, and in the same way the distance of B from the plate can be estimated. If the distance of F be greater than the distance of B from the plate, B is that much on the temporal side of the C.C.A., as is indicated by the difference between the two distances. On the other hand, if B is further from the plate than F, then the foreign body will be that much to the *nasal* side. In the case typified the exact position of the foreign body was

4 mm. deep to
3 mm. above
exactly on vertical } C.C.A.
∴ in globe.

The accompanying charts (Fig. 13) have been suggested by Colonel Lister for demonstrating the position of foreign bodies in the eye, on the lines laid down by Captain J. Herbert Fisher, F.R.C.S., R.A.M.C., in his article in the *Ophthalmic Review*.

EMPLOYMENT OF RADIOSCOPY.

It would appear expedient specially to emphasize the danger of substituting radioscopy for radiography in the localization of foreign bodies except in occasional cases. When a number of cases require attention, radioscopy is undoubtedly the more expeditious, but more than one operator in France has had his face and hands severely burnt by excessive use of the screen. Further, the radiographic plate, even though the structures have a double contour, can afford very definite assistance to the surgeon at the time of operation.

The removal of foreign bodies under the fluorescent screen has been employed to a considerable extent in some hospitals, the following method and precautions being adopted:

The patient is laid on the *x*-ray couch and anaesthetized. The part to be examined is cleansed and covered with a sterile towel, upon which the fluorescent screen is placed. The current being turned on, the diaphragm on the tube box beneath the table is reduced in diameter enough to define the foreign body clearly, which procedure also cuts off all unnecessary rays, and so saves the operator's hands. By pressing on the skin in the neighbourhood of the foreign body and noting its maximum movement it is easy to ascertain at what point the foreign body is nearest to the surface, and it can then be determined whether it should be removed through the original track or whether a fresh incision should be made directly over it. Whichever proceeding be decided upon, the point of a forceps is now introduced and pushed on until it reaches the foreign body. By moving the points up and down alternately it can be noted which movement causes the greatest displacement of the foreign body, and thus it is known whether the forceps occupy a plane above or below it. A little practice enables the forceps to be brought quickly into contact with the foreign body, when they are opened just sufficiently widely to allow it to be grasped without the inclusion of muscle or other structures surrounding it.

As an extra precaution it is well to place a sheet of aluminium 1 mm. in thickness over the diaphragm in order to cut off the soft rays.

RAPID LOCALIZATION OF BULLETS OR SHRAPNEL BALLS FROM A SINGLE RADIOGRAPH ON A SINGLE PLATE.

This method, devised by Captain Pirie, C.A.M.S.,[23] is obviously limited in application, since it assumes that only

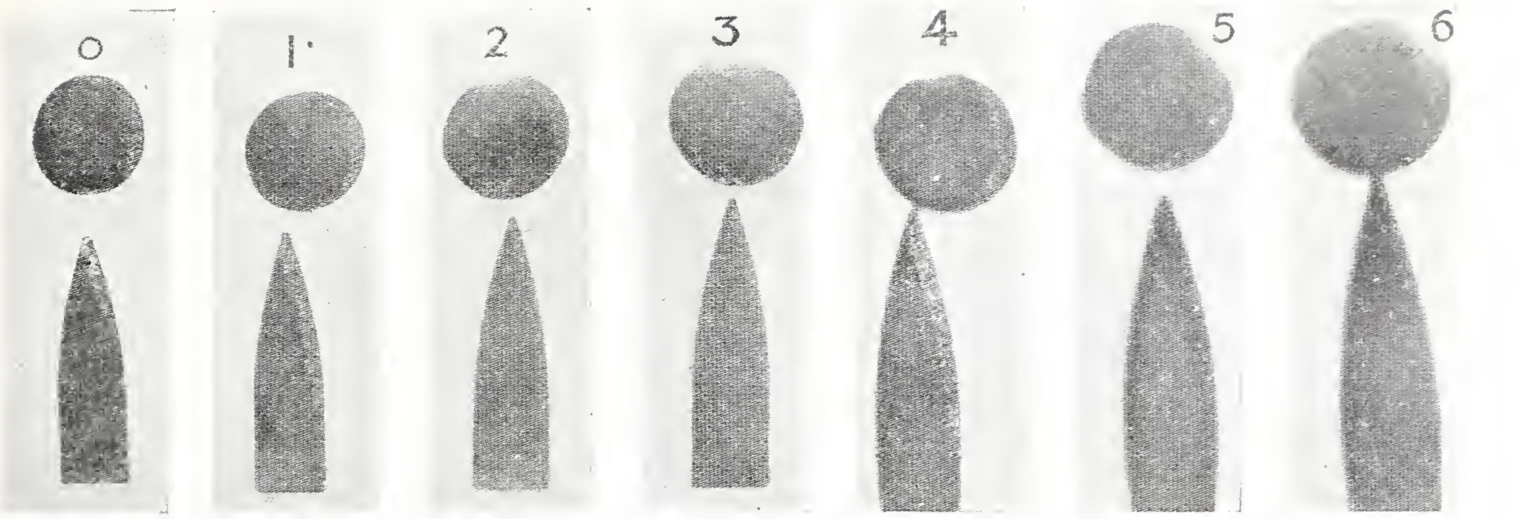

Fig. 14.—Showing bullets and shrapnel balls radiographed at the distances mentioned in inches.

bullets and shrapnel balls of the same calibre are being dealt with.

A key radiographic table is prepared by making radiographs of the bullet or shrapnel ball at the following distances from the plate: 0, 1, 2, 3, 4, 5, 6 in. (Fig. 14.)

The diameter of the bullet or ball casts a shadow the width of which is proportional to its distance from the plate, no matter at what angle the missile may be lying. The length of the bullet forms no guide.

A measurement of the uniformly cylindrical portion of the bullet is made with a fine pair of dividers; the latter are then transferred to the key plate and compared with the shadows; the shadow which they fit exactly, decides the depth of the bullet. The same method applies to the shrapnel ball, provided it is not more than very slightly deformed.

Anatomical Localization of a Metallic Foreign Body and Reconstruction of its Track.

Captain Crymble[24] has shown the practical possibility of combining radiographic results with the information which can be obtained from a study of sectional anatomy. By this combination the actual anatomical position of a foreign body can be determined in addition to its depth from the surface or relation to neighbouring bony points. To attain this object he has employed a series of original coronal and horizontal sections of the body, and also the atlas of cross section anatomy of Eycleshymer and Shoemaker. By marking the vertical and lateral positions of the foreign body on a reconstruction of the part of the body concerned, obtained by replacing the sections in position, the sections corresponding to the position of the missile and the track leading thereto are selected.

Application of the depth measurement from the surface, or observation of the relation of the bone to the surface of the section of the body actually occupied by the missile, then allows the definite anatomical structure enclosing the foreign body to be determined.

The structures involved throughout the entire length of the track may also be worked out by the employment of a reconstruction viewed from the anterior aspect, and another viewed from the lateral aspect. On these the positions of the entry wound and of the foreign body are marked respectively. If no bone lesion is present the positions of the entry wound and of the foreign body are connected by a straight line. Where a bone lesion is present the line is carried from the wound to the bone lesion by a straight line, and from this point a second straight line connects the position of the bone lesion with that of the foreign body. Reference to the anterior reconstruction will then give the lateral position of the track in any section, and reference to the lateral reconstruction will give the sagittal or antero-posterior position in any section.

Crymble points out that the method is seldom needed in dealing with the limbs, but it is more useful in regions like the hip or the great body cavities. Further, anatomical localization both of the track and the missile is of extreme importance in prognosis and treatment in injuries to the head, and also affords a valuable means of studying the functions of the brain.

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ON SOME ANAËROBES FOUND IN WOUNDS AND THEIR MODE OF ACTION IN THE TISSUES.

BY

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The literature on the anaërobes is beset with so many contradictory statements that it is impossible to construct from it an accurate account of the reactions of even the better known organisms. Experience has shown that this confusion is due almost entirely to the investigation of impure cultures, for, with the establishment of a more exact and rigorous technique, the features of individual species are found to become more clearly defined, and previously existing discrepancies tend to disappear altogether.

A Classification of Anaërobes.

All the anaërobes isolated from wounds are probably faecal in origin. They give vigorous fermentation reactions in the presence of organic material, and according to their biochemical activities they may be divided into two main groups—the saccharolytic group and the proteolytic group.

I. *The Saccharolytic Group.*

The members of this group vigorously decompose a variety of carbohydrates with the production of acid and gas, but they are only feebly proteolytic. The group comprises:

1. *B. welchii.* (Synonyms: *B. aërogenes capsulatus* of Welch and Nuttall;[1] *B. perfringens* of Veillon and Zuber;[2] *B. phlegmonis emphysematosae* of Fraenkel.[3])
2. *B. tertius*, (Synonyms: *Bacillus Y* of Fleming;[4] *B. von Hibler IX* or *B. rodella III* of Robertson.[5])
3. *B. fallax* of Weinberg.[6]
4. *B. aërofetidus* of Weinberg.[7]
5. *B. oedematiens* of Weinberg.[8]

Pasteur's *Vibrion septique* would seem to belong to this group, but it is omitted because we have had as yet no opportunity of establishing its characteristics.

The sugar reactions which have been found to hold good after a long series of observations are given in the following abbreviated table, and would appear to furnish valuable evidence in the differential diagnosis of individual organisms from other members of the group. There are four types of *B. welchii* which differ from each other according to their reaction in inulin and glycerin. This finding confirms the observations of Simonds.[9] *B. tertius* resembles *B. welchii* in its sugar reactions, but ferments mannite and salicin in addition. *B. aërofetidus* does not ferment saccharose, and *B. fallax* attacks lactose only after several days, while *B. oedematiens* ferments dextrose, levulose, and maltose only, resembling the individuals of the proteolytic group in this respect. Certain strains of *B. welchii* are slightly proteolytic, and produce small quantities of amino-acids, and *B. aërofetidus* carries the digestion of protein still further, for it produces a very fetid odour in cultures. In neither case, however, is the proteolytic activity at all comparable to that which characterizes the members of the second group.

TABLE I.

	Dextrose.	Levulose.	Maltose.	Saccharose.	Lactose.	Mannite.	Glycerin.	Inulin.	Salicin.	Amygdalin.	Glycogen.
B. welchii I	+	+	+	+	+	–	–	–	–	–	+
,, II	+	+	+	+	+	–	–	+	–	–	+
,, III	+	+	+	+	+	–	+	–	–	–	+
,, IV	+	+	+	+	+	–	+	+	–	–	+
B. tertius	+	+	+	+	+	+	–	–	+	+	+
B. fallax	+	+	+	+	-	–	–	+	+	–	+
B. aërofetidus	+	+	+	–	+	–	–	–	+	–	+
B. oedematiens	+	+	+	–	–	–	–	–	–	–	–

II. *The Proteolytic Group.*

This comprises—

1. *B. sporogenes* of Metchnikoff.[10]
2. *B. histolyticus* of Weinberg.[11]
3. *B. putrificus coli* of Bienstock.[12]
4. *B. cadaveris sporogenes* of Klein.[13]
5. *B. tetani* of Nikolaier.[14]

The individual members of this group digest protein very vigorously, but have a restricted range in the matter of carbohydrate fermentation. *B. histolyticus* breaks down protein as far as the amino-acid stage, whereas the other members of the group push digestion still further to the ammonia stage. They all ferment dextrose, levulose, and maltose. It is probable that *B. sporogenes*, *B. putrificus coli*, and *B. cadaveris sporogenes* are closely related, if not identical.

The term *B. oedematis maligni* of Koch is intentionally omitted from the above list, for we believe that the organism described as such by English writers during the war is really *B. sporogenes* of Metchnikoff. It is significant, too, that no mention of Koch's organism appears in German literature published since the outbreak of war. Its place seems to have been taken by a bacillus which has been described independently by Aschoff[15] and by Conradi,[16] and which is taken by those observers to be a human form of Rauschbrand. It is of interest in this connexion to note that Nicolle,[17] as the result of serological tests, considers the *Vibrion septique* of Pasteur to be closely allied to, if not identical with, the bacillus of Rauschbrand. The organism of Conradi and Aschoff is said to produce in animals a solid oedema of the type which is so characteristic of Weinberg's *B. oedematiens*, but the strong saccharolytic powers attributed to it distinguish it from the latter.

The Incidence of Anaërobes in War Wounds.

The production of a gaseous cellulitis in the tissues surrounding a wound is practically certain evidence of anaërobic infection, although it must be noted that the infiltration of gas may often out-distance the microbic invasion in the tissues. It is not uncommon to find no microscopical or cultural evidence of organisms in the oedema fluid taken from crepitant subcutaneous tissues at some distance from the wound. Another feature of anaërobic growth is the necrosis it produces in the invaded part. Quite apart from wounds which show these clinical manifestations, the majority of open wounds treated at a base hospital in France give cultural evidence of the presence of anaërobes. Out of 100 open septic wounds of all grades of severity examined at intervals of from two to twenty-two days after the receipt of the injury two-thirds showed the presence of *B. welchii*, and almost one-half showed the presence of *B. sporogenes* (see Table II). It is unusual to find only one anaërobe in a wound. In the vast majority of cases the anaërobe infection is a mixed one, the most frequent combination being *B. welchii* with *B. sporogenes*.

In contradistinction to these open wounds, we have had the opportunity of examining a large series of bloody effusions resulting from penetrating wounds of the pleura and lung. In most of the open septic wounds the anaërobes are implanted into, or come in contact with, damaged muscle, whereas in the thoracic injuries just mentioned, which might be looked on as closed wounds, the organisms carried in have to develop in a collection of ordinary blood. Out of 500 specimens of haemothorax fluid examined, 195 proved to be septic, and 44.6 per cent. of these were infected with anaërobes. Here, again, *B. welchii* is the most common infecting anaërobe, and the combination of this organism with *B. sporogenes* is frequent.

The anaërobes tend to remain localized to the tissues during life, and it is only seldom that they can be found in the circulating blood. On the other hand, cases have been recorded from time to time of so-called metastatic gas gangrene in which anaërobes have developed in some position at a distance from the infected tissue. This would seem to occur in a focus which has suffered slight damage, as from continuous pressure or from the introduction of a hypodermic needle, and it is certain that the organisms must have been conveyed through the blood stream. It is quite frequent, however, for anaërobes to become disseminated through the blood stream immediately before death. Out of 40 cases in which death resulted from wounds which were proved to be infected with anaërobes, the heart blood taken from one to twenty hours after death gave a positive cultural result on twenty-five occasions. In 20 of these cases *B. welchii* was found (that is, in 80 per cent.), and in 15 (that is, 60 per cent.) *B. sporogenes* was present.

TABLE II.

	Total Examined.	Total Septic.	Infected with Anaërobes.	Infected with B. welchii.	Infected with B. sporogenes
Open wounds 2 to 22 days old	100	100	72%	66%	48%
Haemothorax fluids	500	195	87 = 44.6%	71 = 36.4%	14 = 7.1%
Post-mortem heart blood	40	36	25 = 69.4%	20 = 55.5%	15 = 41.6%

The Pathological Process Produced by Anaërobes in the Tissues.

The incidence of anaërobic infection in wounds during the present war would seem to be determined by two factors. The first is the unavoidable soiling of a wound by earth or by clothing infected with faecal organisms. Secondly, the destruction of tissues produced in and around a wound by the modern missile gives rise to just those conditions which are most favourable for anaërobic growth.

The implantation of anaërobes in a focus of dead organic material is directly comparable to the inoculation of an artificial culture, and it is for this very reason that a laboratory study of the activities of anaërobes in artificial media is of service in determining the nature of the earlier pathological processes which follow infection of the tissues. In the wound, just as in the test tube, the members of the carbohydrate splitting group of anaërobes are the first to develop. The glycogen which is found in living healthy muscle is rapidly converted after death into dextrose and a small fraction of isomaltose. Both these substances are vigorously fermented by such an organism as *B. welchii*, and it is because of their presence that the organism in question so readily establishes itself in damaged muscle.

This early fermentation in muscle results in the formation of acid and gas. The latter consists of a mixture of carbon dioxide and of hydrogen in varying proportions. It often develops with astonishing rapidity, and may become clinically evident four to six hours after the receipt of the wound. The appearance of crepitation in the subcutaneous tissues is probably due to gas which has escaped from subjacent infected muscle.

The gas may accumulate under considerable pressure, and, in so doing, it adds to the embarrassment of a circulation which is already impeded by the presence of inflammatory exudate.

Coincident with the production of gas is a formation and setting free of various organic acids. The acids which occur in the *in vitro* fermentation of carbohydrates by *B. welchii* retard and finally inhibit the growth of the organism, and, unless there is a high amount of available protein present, the culture dies out rapidly. If, however, some method be adopted of neutralizing the acid as that is formed, as, for example, by the addition of calcium or of magnesium carbonate to the culture, then the growth is not only much more luxuriant but its vitality is considerably increased.

In infected tissues such a neutralization is brought about by the inflammatory exudate, for the buffer salts of the serum constitute an absorbing reservoir which will take up any excess of free acid, and it is only when this considerable reserve is used up, if ever this does happen, that one can expect to find an increased hydrogen ion content of the circulating blood.

There is, however, another contributing factor to the neutralization of acid, a factor which comes into operation in the later stages of bacterial growth. The early rapid growth of the saccharolytic group is succeeded by the more gradual development of members of the proteolytic group. The protein constituents of the damaged tissues are attacked by the digestive ferments elaborated by organisms of this second group, and are broken down by successive stages. The final product consists largely of ammonia bodies, and it is these that help to counteract the acids resulting from carbohydrate degradation.

It is probably just at this point that certain saccharolytic organisms become proteolytic, and throw in their lot with the real tissue digesting organisms.

The gas formed in the proteolytic stage of wound infection is malodorous because of the development of sulphuretted hydrogen and certain volatile bodies.

It is probably during the proteolytic period also that the toxic products are elaborated which give rise to the clinical condition of toxaemia. It is very unlikely that such a condition is established as the result of carbohydrate fermentation. The clinical picture of a man dying with anaërobic toxaemia is chiefly that of a rapidly progressive circulatory failure, and death may come so abruptly that it is often falsely ascribed to pulmonary embolism. It never bears a resemblance to that state of "air hunger" which clinical pathologists have proved to be associated with blood acidosis.

One may, then, summarize the pathological processes in an anaërobe-infected wound as being characterized by two main features—the production of gas and the death of tissue. Each of the two main groups of anaërobes above defined has its share in these processes, and the successive stages by which an anaërobe infection develops may be thus summarized:

1. The initial trauma in determining the death of tissue establishes a focus for growth. This is characterized by the latent period, which precedes any obvious clinical signs of anaërobic infection.

2. The first active phase of anaërobic infection consists in the development of the rapidly growing saccharolytic organisms, of which *B. welchii* is the chief. It is because of the richness of muscle in fermentable carbohydrate that this tissue provides such favourable conditions for the growth of organisms of the saccharolytic type. Their development results in the production of acid and gas. The gas accumulates first in the muscle and reaches the subcutaneous tissues by escape from the muscle. The pressure produced by gas and also by inflammatory oedema fluid leads to an anaemic condition in the tissues surrounding a wound, and this change initiates the second active period of anaërobic invasion. The muscle in the saccharolytic period is of a brick-red colour.

3. The second phase of anaërobic infection in a wound consists in active proteolytic digestion. This is characterized by death and digestion of the tissues. The process is accompanied by the formation of sulphuretted hydrogen and of volatile substances, which give the penetrating putrefactive odour so typical of the later stages of infection. The previously red muscle becomes soft and diffluent. It may be stained black by a sulphide of iron formed by the interaction of sulphuretted hydrogen with the iron released from broken-down haemoglobin. The toxaemia which develops at this period results from the absorption of toxic substances produced in the breaking down of the protein molecule, and cannot be attributed to the acid which is formed in the breaking down of the carbohydrate molecule.

4. The final phase is that of successful bacterial invasion of the blood stream. It occurs in most cases just at, or immediately preceding, the death of the individual.

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CHAPTER VIII.

MILITARY ORTHOPAEDIC HOSPITALS.

BY

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PART I.—PRINCIPLES AND TREATMENT.

THE contributions made to surgical science by Great Britain in the last hundred or hundred and twenty years have placed the world for ever under a debt to the savants of this country. The discovery, about the year 1799, by Sir Humphry Davy that anaesthesia could be induced by vapour inhalation and the suggestion that nitrous oxide might be used with advantage during surgical operations;[1] the introduction of the antiseptic system by Lister, and the publication of the *Origin of Species* by Darwin which firmly established the principles of the law of evolution—these all effected a complete revolution on medical thought both as regards its theory and its practice. To show how great the revolution was a reference may be made to Lister's papers and more especially to the year 1873.[2] At that time a Scottish medical student was receiving his training in surgical wards from which hospital gangrene, blood poisoning and erysipelas had been banished, and he was witnessing operations under chloroform anaesthesia, the mortality from which in Syme's first series of 5.000 cases was *nil*. In anatomy not only could he, like Hunter, study man in relation to the animal world, but, thanks to the genius of Darwin, could study each animal in its sequence to some other. The law and order of function and structure took the place of chaos.

It is interesting to note that about that time a commission was sent to Edinburgh from Germany under Lindpainter. The wards of the hospitals of that country were foul with sepsis, and the magnificent hospital in Munich was about to be destroyed owing to the prevalence of blood poisoning, 80 per cent. of all wounds being affected by hospital gangrene. From this country, after a year spent in acquiring principles and methods, the German Commission took away a sound knowledge of the antiseptic system, anaesthesia, and of comparative biology—the three factors to which modern surgery owes its existence. After Lindpainter's return from Edinburgh not a single case of hospital gangrene occurred in the Munich Krankenhaus, and pyaemia and erysipelas were banished.

The effects on surgery of the introduction of the antiseptic—or, as called later, the aseptic—system were immediate. Its greatness was recognized throughout the world, and everywhere surgical wards and operating theatres were modelled on the British principle. The cranium, thorax, and abdomen could now be explored, and cases always regarded formerly as hopeless were rendered curable.

Unfortunately, the simplicity and power of the antiseptic system was not unassociated with danger. It placed a force in the hands of men who were apt to forget that a knowledge, if not of comparative, at least of human anatomy was the essential basis of all surgical treatment. If Lister regarded surgical treatment as largely a question of asepsis, it was because he recognized sepsis as surgery's curse, against which he bent his titanic energies, and over which he finally triumphed. Listerism was associated with action. In itself it did not convert the practice of surgery from an art into a science.

Why Britain's contribution to surgery stands unequalled is that not only did it introduce to the world the antiseptic or operative system but also its complement—the conservative system. Not only did it offer the world a system by which, for example, a tuberculous joint could be excised or explored without risk of sepsis, but also a method by which the joint, treated conservatively, could be absolutely cured. This complement we owe to a Welshman whose greatness is now only beginning to be generally recognized, and whose life, "teeming with good deeds done," was prematurely cut off at the early age of 57. I allude to Hugh Owen Thomas of Liverpool, of whom Professor Steele, the eminent American orthopaedic surgeon, in his oration on Thomas delivered before the Orthopaedic Congress at Washington,[3] said: "In orthopaedic surgery more of originality and practical therapeutic suggestion has been given by no one. I have greatly enjoyed perusing his works, and it has not been without profit; I trust that what he has left in print will be found in the library of every member of our Association, for from no single source within our own times has so much of orthopaedic originality and suggestive practice emanated."

As Thomas's work was so bound up with the principles of muscular action, and as we recognize that the restoration of muscular function to the normal is the foundation of all orthopaedic treatment, whether active or passive—and this applies equally to injury of muscle, nerve, nerve centre, joint or bone—a reference is necessary to certain fundamental principles connected with nerve and muscle discovered in this country, so that the position of Thomas can be clearly defined.

Professor Keith has told us that Hunter devoted a large amount of his time to the study of muscle and bone, and first distinguished between nerves of ordinary sensation and nerves of special sense. Hunter's Croonian Lectures[4] on the physiology of muscular motion probably constitute his most important work. In studying movement not only did he go to the lowest forms of the Invertebrata, but also to the vegetable world, just as in investigating form he studied crystals. Hunter differentiated atrophy of muscle from disuse as well as from disease. He differentiated between velocity and force of action, and dealt with the adaptation of muscle to joint, and of muscles going over more joints than one.

He recognized that relaxation of muscle was a power as much depending on life as contraction, and not, as had been previously taught, a simple cessation of action. The state of rest he regarded as the state of inaction. "The elongation of a muscle is not the immediate result of its relaxation." Thus, if we take such an apparently simple movement as flexion of the finger, the stimulus which excites contraction of the flexors produces also a relaxation of the opponent extensors. The flexors by their contraction become the elongators of the relaxed extensors, and these relaxed and elongated extensors become by their subsequent contraction the cause of elongation of relaxed flexors. These two groups Hunter defined as "Reciprocal Elongators."

> These reciprocal elongators, then, by their mutual action on each other bring out a middle state between the extremes of contraction and elongation, which is the state of ease or tone in both. Either extreme of motion leaves the muscle in an uneasy state. We find, then, that as soon as any set of muscles cease to act, the elongators, which were stretched during their action, are stimulated to act in order to bring these parts into a state furthest removed from the extremes which were uneasy and by which the stimulus arising from both is equally balanced. The elongated state of a muscle is an uneasy state—a muscle, therefore, that is stretched, although in a relaxed state, is uneasy, and will contract a certain length to what is probably the middle state.

We recognize that a muscle which has relaxed and elongated *pari passu* with the contraction of its opponent cannot at the same time be in a state of contraction. If the extensor communis digitorum extended the two distant phalanges we could not have extension of the metacarpo-phalangeal joint with flexion of the interphalangeal joints. Yet we can readily perform this. Nor could we have extension of the interphalangeal joints with flexion of the metacarpo-phalangeal, yet this normally also can be performed. A muscle cannot at one time help the extenders and at another the benders. To allow the opponent flexors to act, it, as an extender, becomes relaxed and elongated. Then, in some extraordinary way, this relaxed muscle fibre is supposed at the same time to be contracted and shortened to help the flexors.

Following shortly after Hunter came the brilliant researches of Charles Bell, whose classical work on the nervous system undoubtedly forms the basis of our knowledge of the physiology of the subject. For his work on respiration alone Bell's fame could stand. But Bell did more than that. In his own words he thus describes his great discovery.[5]

> I have now only to add that my opinions and experiments have been followed up to the satisfaction of all Europe. It has now been acknowledged that the anterior roots of the spinal nerves bestow the power of muscular motion, and the posterior roots sensibility. When the anterior roots of the nerves of the leg are cut in experiment, the animal loses all power over the leg, although the limb still continues sensible. But if, on the other hand, the posterior roots are cut, the power of motion continues although the sensibility is destroyed. When the posterior column of the spinal marrow is irritated the animal evinces sensibility to pain, but no apparent effect is produced when the anterior column is touched.

In the year 1832 Bell's experiments were followed by the discovery in London by Marshall Hall of the reflex function of the medulla oblongata and medulla spinalis. In addition to the three modes of muscular action previously recognized—namely, voluntary, that of respiration, and the involuntary—Marshall Hall recognized a fourth, namely, the reflex action.

> The first three modes of muscular action are known only by actual movements or muscular contraction. But the reflex function exists as a continuous muscular action, as a power presiding over organs not actually in a state of motion, preserving in some, as glottis, an open and in others, as sphincters, a closed form, and in the limbs a due degree of equilibrium or balanced muscular action.

Not only did Marshall Hall discover and define "reflex action" but recognized the reflex function as the source of equilibrium in the muscular system. His original paper, read before the Royal Society,[6] in which his experiments are detailed, should form part of the armamentarium of all orthopaedic students. Then will they recognize in true perspective the work of the minor satellites who have audaciously associated their names with side issues of this great discovery.

The basic principle of the study of anatomy during the time of the Hunters and the Bells was function. Largely through the influence of Cuvier in France and Owen in this country—although the latter was curator of the Hunterian Museum—the study of the functional system was superseded by that of the structural, and it is idle to deny that the descriptive method, with its pernicious examination backing, accounts for the negligence with which not merely comparative but human anatomy is studied. As Charles Bell himself wrote: "The one chief purpose in studying the anatomy of the human body is to understand its functions and to compare them with those of other creatures till we arrive at last at some distinct conception of the whole; of the various structures of animals and vegetables; and of the various functions which in each of these classes support life and action, and through it the principle of life."

With the publication of the *Origin of Species* and the placing of the Law of Evolution on an unassailable basis a new weapon for the study of function was placed in the hands of the medical profession. Function could now be studied from the point of view of correlation, and structure from the point of view of necessity. Yet even this mighty impetus has so far failed to slacken the hold of the descriptive system on the medical curriculum, although in the last few years there are all the evidences of change.[7]

Unfortunately the descriptive system received in the antiseptic system a powerful ally. Cleanliness, a knowledge of technique, and of position of the main bodily structures, have for the last half-century constituted the main armamentarium of the operating surgeon.

To concentrate our attention on function as embodied by conservatism was the ideal which H. O. Thomas formulated. For that ideal, unpopular then as now, he fought throughout his all too short life. It was a fight that required a man with giant energies and an unswerving belief in his own principles. With what contempt must the young surgeon have looked on Thomas, who, discarding the ease with which—thanks to anaesthesia and antisepsis—a joint could be excised, preferred to "cure" the joint by scientific rest. His death, just as in Hunter's case, excited little interest in his own country. Not so, however, in America and Australia, where the scientific value of his principles was well known. The mists of prejudice are now becoming cleared from men's eyes as it is realized more and more that Thomas's principles embody the application of the functional method to practice. This, after all, is the only scientific method, because it is founded on the basis of the true anatomy—namely, the biological or comparative.

Thomas made in all ten contributions to medical science, and of these the most important are *The Principles of the Treatment of Joint Disease*, and *The Principles of the Treatment of Fractures and Dislocations*. He can be regarded as the apostle of the conservative or rest treatment of joints, bones, and muscles—not surgical rest, so called, but anatomical rest. He knew, of course, that complete rest could only be attained *post mortem*. In his methods he aimed at effective immobilization, abolition of concussion, and avoidance of pressure.

To his medical knowledge he added a sound acquaintance with the principles of mechanics and mathematics. The keynote of his work is to be found in his knowledge of the physiology of muscular action. Thomas recognized that in inflammation of a joint the altered position relative to the normal which the parts comprising the joint assumed was due to muscular action and not to so-called increased tension. Increased tension he knew could not cause movement. He looked on muscles as sentries needing control but not structures to be forcibly stretched or subcutaneously divided, as was taught.

> Hip and other joint deformities accompanied by inflammation arise mainly from the effort of the patient by the exercise of his will to pose the limb in the easiest position and fix the articulation, without which ease could not be gained. Knee-joints are not infrequently presented to the surgeon suffering from liquid distension only, which the muscles appear to know, for there is an absence of any deformity as there is no special muscular intervention. The articulation, however, is fixed more effectively by art than by the natural method of muscular action. In fact, a through fixation of a diseased joint is a physical method of physiologically suspending or disconnecting for a time muscle influence from a joint, and this inhibition of muscular interference will be the more complete just in proportion to the practical efficiency of mechanical aid.

Rest of the joint was secured by controlling all the muscles which produce or tend to produce movement. He rested the joint in the position naturally assumed in the inflamed condition owing to muscular action, the deformity being reduced gradually as the joint recovered. He gave relief to the unhealthy portion by action on the healthy—that is, he attached his controlling appliance to the sound portions only of the limb to which the diseased articulation belonged, and not as was usually advised to the diseased part, inasmuch as he knew that in this way the diseased area was subjected to pressure. Traction in the line of deformity he knew would be endless traction and that it was impossible for a flexed hip-joint to have its angle from the plane reduced if the traction were constantly at that angle.

> No matter what the primary cause of the disease in a joint, whether it be induced by trauma, struma, syphilis, gonorrhoea, or rheumatism, rest cannot be dispensed with, for, if surgery does not step in, Nature is sure to intervene by the muscular method, knowing that arrest of motion is the one thing needful before all others. In man's evolution it was his only chance of recovery from hip-joint inflammation.

It was his practice when treating a diseased articulation by enforced rest never to test for motion so long as resolution of the disease was not seemingly established, and then in the gentlest manner possible. No amount of rest, he knew, would produce ankylosis in a joint free of disease. It might produce stiffness, which is only a trivial and temporary hindrance. Between a stiff and an ankylosed joint is no analogy beyond the absence of motion. His views on ankylosis of joints were years ahead of his time.

> In the condition of diseased articulation we find inflammation and the accident attendant on it—namely, deformity. To the treatment there can only be applicable the principle that the most perfect and continuous practical immobility should be enforced so long as unsoundness is known to exist. To this principle there is no exception. The more completely

> an unsound joint is maintained at rest, if the rest arrests friction and removes pressure, the sooner it will become sound and able to endure pressure and friction, the probability of ankylosis remaining is diminished, but if ankylosis results—and it cannot always be avoided—it should be accepted not as evidence of defective treatment, but rather as an indication of the intensity of the disease. The purpose of treatment should not be to induce ankylosis, as is so often done under the supposition that such a limb is better suited to the wear and tear of use, or that relapse and recurrence were not so liable to happen if ankylosis of an articulation occurred. An unsound ankylosis is quite as liable to retrogression with motion as an unsound joint. Deformity is evidence of Nature's attempts to secure rest for the articulation by fixation of the joint. It is Nature's mode of immediate help. Ankylosis is Nature's reserve assistance. Ankylosis prepares to fix the joint when the method by muscular control begins to fail. The surgeons of the past judged deformity to be an unavoidable defect, and ankylosis as often a necessary evil. But deformities are avoidable, and ankylosis is in no instance to be desired, though it may be in the presence of certain conditions an unavoidable termination. The fact that there has hitherto been no sure test of recovery has led to the belief that joints which have been excised are less prone to subsequent trouble from recurrence of unsoundness. It has always been a favourite argument that without excision the diseased joint is the subject of frequent and unexpected relapses, whereas the real cause of relapse has been the fact that treatment was in past time suspended ere soundness of the articulation had been secured.

Thomas was careful to distinguish clinically between healthy, inflamed, ankylosed inflamed or unsound, ankylosed but sound, sound or recovered, and deformed joints.

> In an unsound ankylosis progressive and evident motion will follow use if the limb in which the ankylosis exists be employed for its usual purpose, while in an ankylosed but sound articulation ordinary daily use cannot bring on any variation of position, an indication that such condition should be termed true ankylosis. An inflamed joint is an articulation the radius of action of which is gradually diminishing. The diminished radius of action designated joint deformity tends to increase so long as the joint is unsound and untreated, and is caused solely by the efforts of Nature to practise immobility as a means towards aiding restoration. A sound or recovered joint is one from which traces of previous inflammation have passed away. In evidence of this sound condition and complete recovery it is noticed that by ordinary daily use the radius of action to and from the position maintained during treatment is seen to be gradually increasing no matter in what position the limb may have been fixed during treatment—an infallible sign of soundness and a justification for no further restraint or surgical interference.

He protested against the terms true or bony and false or fibrous ankylosis.

> The expression false and true ankylosis should refer to the permanency of the rigidity, not to its structure; that is, no ankylosis which will vary either by test or use should be termed true ankylosis and no ankylosis which remains immovable by either test or use should be termed false ankylosis. As long as false or unsound ankylosis lasts there is always a prospective chance of recovery with complete or some motion by use alone.

He was careful to insist on a utilitarian position should ankylosis be inevitable. At the elbow flexion not extension; at the hip and knee extension; at the ankle with the foot at a right angle; at the wrist dorsiflexion, ordinary flexion giving a weak finger grip in grasping. In vehement terms he denounced the breaking down of contracted joints, a practice unfortunately still followed by some.

> Joints that have perfectly recovered either from injury or disease regain motion earliest by their being employed in their ordinary manner. Joints that are not in a healthy condition automatically resent attempts at compulsory employment. Passive motion applied to joints injured or diseased delays recovery, and if applied to joints cured it delays the event of complete restoration of function. The good repute which the public has given to bonesetters, osteopaths, passive motionists, shampooers, manipulators, and Bethshanites rests upon the fact that these unscientific practitioners get the charge of joints and fractures when their cure has been consummated and merely preside during the resumption of function. They only watch the rising sun and profess to assist its cure practising certain flexions, extensions, twists, jerks, and pushes, with passive motions and other details evidently intended to give proper dignity and importance to their proceedings. The treatment, however, which the sufferer is most in need of he seldom meets with—namely, no motion. As soon as the part under treatment has become healthy it will resume its function more fully and readily rather by the attempts of the late patient to use the part than by supplemental violence, such as passive motion or violent manipulations. If the part be sound its range of function increases with use. If ankylosis can possibly wear off it does so best by the patient's attempts at ordinary use of the part.

Treated on the above principles, he confidently asserted that every case of hip-joint could be cured without leaving a fractional deformity of flexion, and consequently without any shortening except that arising either from the arrest of growth where inflammation has interfered with the growing points in the upper part of the femur or from erosion. He asserted the same as regards the treatment of knee-joint disease. He was a bitter opponent of the indiscriminate excision of joints.

> Joints injured or diseased when they show no signs that may lead us to think they can recover, should be amputated. My contention has been that the joint that can recover after excision can recover without it, and joints that do not recover after excision ought to have been removed by amputation.

He never once excised an elbow-joint, and states:

> I have never met with a case of excision of the elbow which equalled in usefulness a diseased elbow-joint truly cured. Even if ankylosis remain, the part, if sound, is less liable to relapse or give future annoyance to the patient than after an excision, however successful.

That has been the experience of Peter Bennie, the distinguished Australian surgeon, during thirty years' application of Thomas's principles. "I have never," he writes, "seen a case in which amputation for hip disease was necessary, and if the joint is properly fixed by a Thomas hip splint excision will never be required."

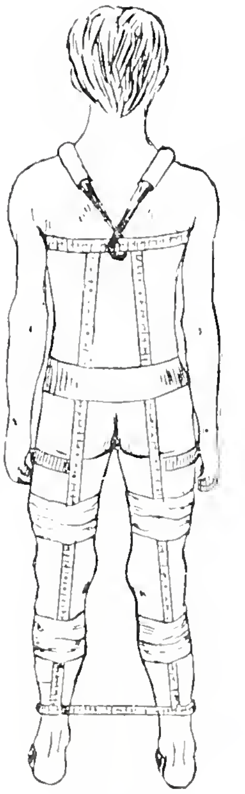

Fig. 1.

Fig. 1.—The double Thomas hip splint applied. (After Thomas.)

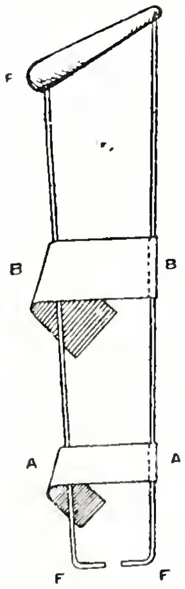

Fig. 2.

Fig. 2.—The caliper knee walking splint. (After Thomas.) E, Ring at upper thigh. B, Band behind knee. A, Band behind lower third of leg. F, Inserted into socket in boot heel.

To put these principles into practice Thomas introduced to the profession many ingenious appliances, of which the best known are the hip or dorsal fixation splint and the knee splint, the varieties of which are the "bed" for resting and the "caliper" for walking, which latter, by transmitting the weight from the hip to the heel, enables the patient to walk with the knee at rest. The knee splint has been the most universally used splint in the war. The hip splint, though quite simple in construction, is probably the least understood of all his splints; this, however, is the result of prejudice and of ignorance of principles both of mechanics and of rest. It is the only splint in the world whose application has been raised to a science. I allude to P. B. Bennie's formulae for the accurate fitting of the splint and the correction of deformities. One formula is:

$$\sin\theta = \frac{\cos\alpha,\ \sin\beta}{\sqrt{(1 - \cos^2\alpha,\ \cos^2\beta)}}.$$

Where θ = angle through which the plane of the splint is rotated in the direction of the lateral displacement, α is the angle of flexion required calculated from 0° as normal, and β the angle of adduction or abduction, the rotation being made just above the joint and the flexion opposite the joint.[8]

For elbow flexion Thomas used a halter and collar; for the wrist a simple tin splint to hold the joint in the position of dorsiflexion; for the dorso-lumbar spine a cuirass; for cervical disease a leather collar; and for ankle disease the simple "crab" splint.

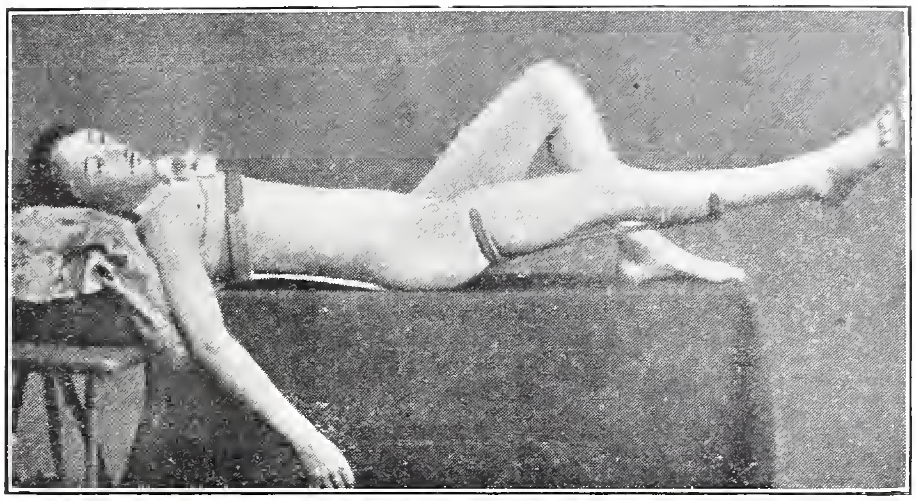
Fig. 3.—Effective rest of right hip-joint by Thomas's dorsal fixation splint. (After Bennie.)

Thomas's work on fractures is pregnant with original ideas. A brief mention may be made to some important principles. Efficient fixation, he asserted, best assists the restoration and repair of the part fractured.

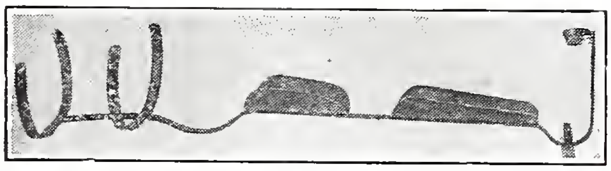
Fig. 4.—The combined hip and ankle splint illustrating a simple means of resting hip, knee, and ankle joints.

Perfect rest of a fracture, if it could be maintained without supplemental art and interference would best permit the repair of fractures up to a normal condition. If a fracture is in proximity to a joint the limb ought to be so fixed that the utmost prospective usefulness may be afterwards gained should the joint have also suffered an injury indirectly.

In fractured olecranon he merely advised the extended position, but if the fracture were compound, flexion, he said, should be maintained during treatment lest the injury may run a course ending in the loss of motion of the joint.

He was careful to distinguish between non-union after fracture of bone and delayed repair.

Non-union should apply only to those fractures which have resulted in a cartilaginous, or otherwise, connexion having formed between the points of fracture—the bony points not being in actual contact. Examples of delayed repair are common, while those of non-union are rarely met with. The gravity of delayed repair depends on the locality. If found in the shaft of a bone it is not so easily remedied as when it occurs at an extremity.

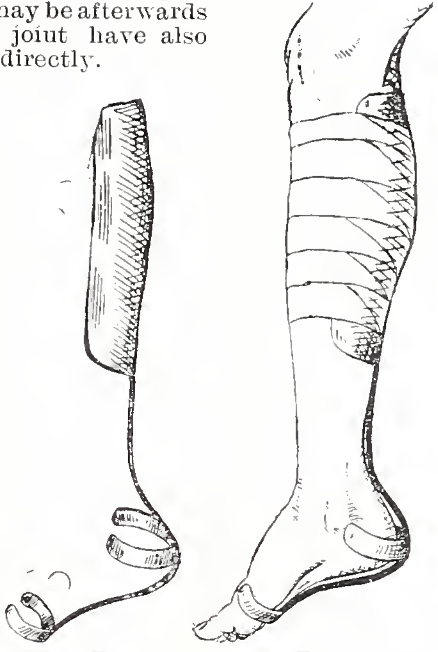
FIG 5. FIG. 5A.

Fig. 5.—The simple "Crab" splint for resting the ankle and foot.
Fig. 5A.—The same applied. (After Thomas.)

He states that in the early years of his practice he invariably interfered with instances of delayed repair by saw, wire, rasping, and pegging, but during the later years he succeeded better without direct interference, although most of his cases were less hopeful of success than his earlier cases.

> In these days of autisepsis it is not uncommon for even a recent fracture, especially if compound, to be at once drilled and wired or pegged, when ordinary mechanical appliances intelligently used would be better. This practice I hold to be a retrogression in the surgery of fractured bones; indeed, if we are more thoughtful of the fact that it is living matter that we have to manage, then it would seem that even in delayed union of fractures actual interference, such as drilling and excising, will seldom be required—nay, it will be found that such operations are in some instances a hindrance rather than an aid to repair, and operations of this character would then be reserved for old chronic cartilaginous connexions only.

He preferred to give cases of delayed union conservative treatment before operating—stimulating the part by compression and percussion combined with efficient fixation of the fractured area. At first he did not regard efficient fixation as essential, but later insisted on it as he found the time for repair shortened. By this mode of treatment he was invariably successful. Percussion was applied with a rubber-protected mallet all round the site of fracture—the skin being protected by felt—about every third day for four weeks. Prolonged tumefaction for a distance around, above and below the fracture, was enforced by means of rubber bands. In a case of ununited fracture of

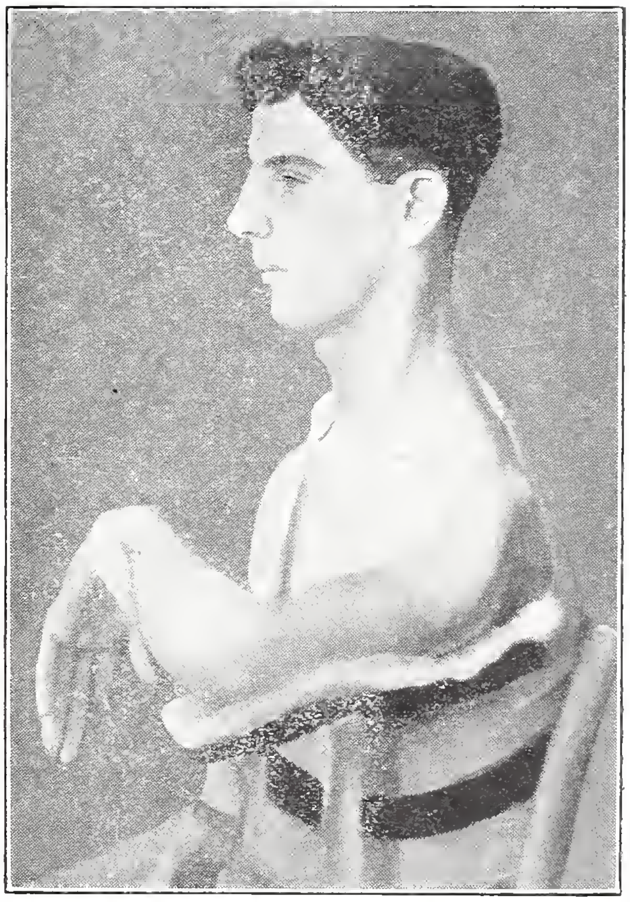
Fig. 6.—Gunshot wound of upper end of left humerus rested on pper limb abduction splint.

the humerus of nine months' standing, which he treated successfully, he practised percussion weekly for four weeks and practised daily for half an hour "damming" the circulation around the fracture. It is interesting to note that he regarded percussion as a means of bringing about an increase of bony structure even in cases of non-fracture. It is important to remember that Thomas was the originator of the congestive or hyperaemic treatment, although it received little notice in this country till associated with the name of a foreign surgeon.

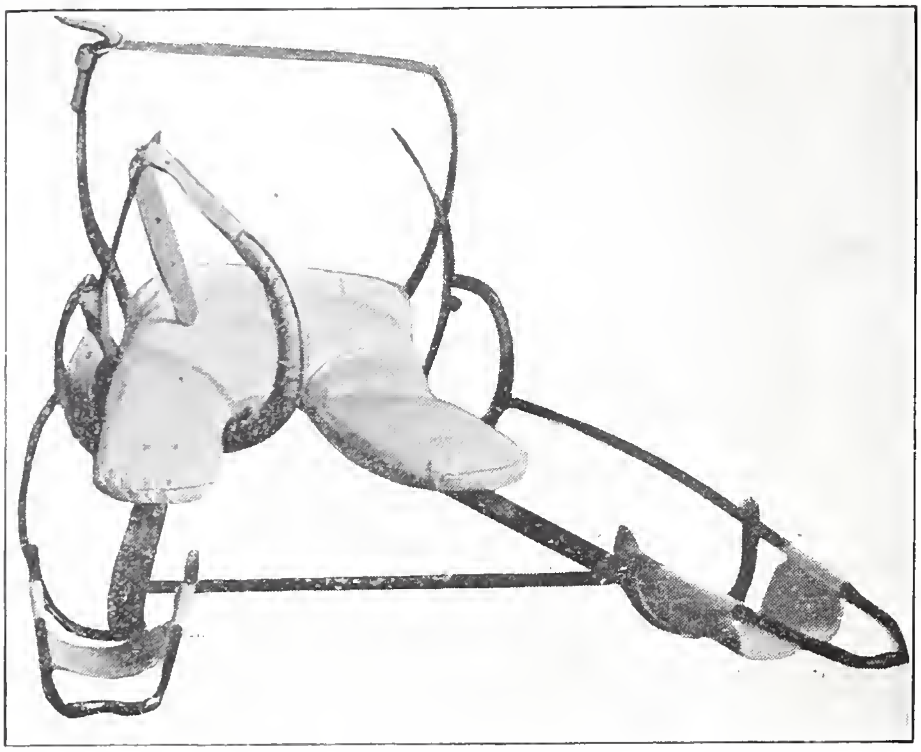

FIG. 7.

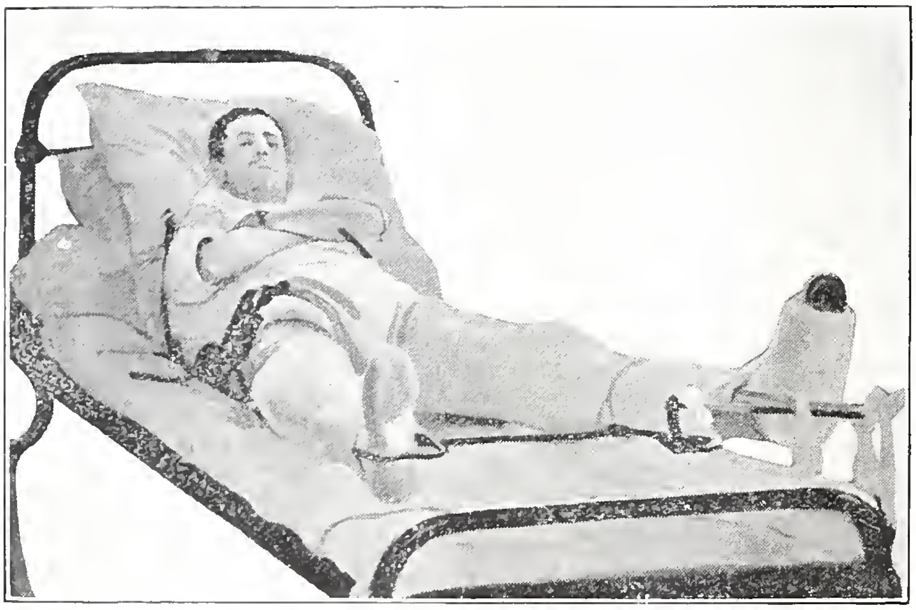

FIG. 7A.

FIG. 7 The Robert Jones abduction frame. Used especially for old ankylosis of hip and to overcome shortening in malunion of femur. FIG. 7A.—The same applied.

Muscle.

Thomas's important contribution to the surgery of nerve and muscle is that associated with the treatment of dropped wrist. More important than that, however, is his explanation of so called contracted muscle and contracted tendon:

> The term contracted muscle is a misnomer—a shortening of true muscular tissue from long-continuous action does not occur. Neither true muscular nor true tendon structure, as long as it is not diseased, can be shortened or lengthened. During the action of true muscular structures the fibrous ramifications radiating from the tendinous origins and insertions of muscles and connecting the true muscular structure become wrinkled, and if the true muscular tissue remain long and continuously active the folds of fibrous tissue become obliterated: and when the true muscle is tired out the contraction of this tissue acts to mechanically fix in a special position the part subjected to the control of that muscle.

This, together with alterations in the form of and around the articular capsule and possible connexions between the bones forming the joint he regarded as the factors maintaining the permanency of joint deformity. As a clinician he noticed that muscles possessed of much divergent fibrous tissue, as soleus and gastrocnemius, are the most prone to permanent and obstinate contraction, while much permanent rigidity of muscle is seldom met with in such a muscle as the sartorius, which possesses little fibrous tissue, except at origin and insertion. As further evidence, he regarded the fact that the true muscle of a tendon that has been severed will resume duty in a few days. An unhealthy condition of a joint and the necessity to place the components in the position of ease, constituting deformity, become the stimulus to contraction of one set of muscles and to relaxation and elongation of the opponents. In a joint deformity we are always dealing with these two factors. This muscle state is maintained as long as the necessity persists, but the muscles themselves are not diseased. If the abnormal position be prolonged owing, for example, to the severity of disease, reduction may be interfered with by secondary changes—namely, contraction of the intermuscular fibrous tissue, alterations in the capsule or perhaps bony or fibrous connexions between the joint surfaces.

Recognizing these factors and also that the deformity has been gradual in development—the contracting and shortening of one muscular group occurring *pari passu* with relaxation and lengthening of the opponents—such a procedure as forcibly breaking down a contracted joint must be condemned as absolutely unscientific and only worthy of charlatans.

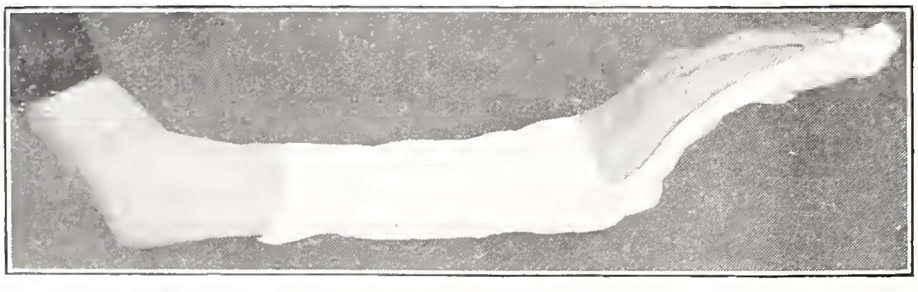

FIG. 8.—Long plaster "cock-up" splint for musculo-spiral paralysis.

Wrist-drop.

In the condition known as "wrist-drop," Thomas, instead of assuming that this was permanent and irremediable, argued that the primary cause may have been temporary, and that elongated extensors were mechanically prevented from contracting. They were not of necessity permanently paralysed and stretched. For purposes of prognosis he used a simple and effective test. "If the patient be asked to try and perform by the exercise of the will only greater flexion than already exists, the fingers flex readily, and also by the act of the will extend forward again to the position of previous repose." Furthermore, "while the wrist is firmly flexed by supplemental assistance the patient can by the exercise of his will within a small radius rapidly flex and extend his fingers." Success in these tests enable a favourable prognosis to be given, and Thomas was successful in a case of eighteen years' standing. A recent case usually recovers in one to four weeks and an old one in six to twenty weeks. In treatment by means of a simple "cock up" splint the hands and fingers are maintained in relation to the forearm in the position of extreme extension "so as to allow the muscular tissue of the extensors of the wrist and fingers to retract from the overstrain or overdraw." On removal of the splint by the surgeon to test the result, "should the patient by the exercise of his will be able to maintain extension, the surgeon may allow the limb to be used, discontinuing the angular extension apparatus." Thomas did not of course regard this treatment as universally successful in all cases of dropped wrist or ankle, and in connexion with poliomyelitis he wrote:

> It is my experience that those cases which we meet with after infantile paralysis of the upper extremity are the most untractable because that the central nerve lesion in these cases is never perfectly recovered from; and, again, in many of these cases we have to contend with a dropped condition of shoulder, elbow, wrist, and fingers in subjects who do all they possibly can to thwart our endeavours to assist them.

Thanks to Robert Jones, these important views of Thomas on muscle, greatly amplified, have been introduced to the notice of the profession, and it would be idle to deny that round them is being built up the modern surgery of nerve and muscle injury.

Nerve Lesions.

Thomas directed our attention to the treatment of muscle in cases of nerve injury. Weakened or paralysed muscles must be rested just as a diseased joint or bone must be rested. The healthy opponents should not be allowed to contract, producing a stretching of the weakened group. Such conditions as contracted fingers or joints should never be allowed to occur, and should they be present they should be remedied before any operation is undertaken. In recent cases of divided nerve, where the diagnosis is certain, a reparative operation is essential. In old cases it is surprising what improvement can be effected by means of rest, together with scientific re-education aided by the patient's volition. Speaking generally, no operation should be undertaken till these methods have been exhausted.

In cases of injuries of nerves the ends are freshened and sutured. If a gap exist between the divided ends it may be necessary to flex a joint—for instance, as the elbow—or alter the position of the nerve. Should these fail, the gap may be bridged by a long segment of a sensory nerve or by strands of catgut, but it must be remembered that such operative treatment is only the beginning. The mere transmission of an impulse along a sutured nerve is not sufficient to cause recovery of muscular action, and that is the important thing. The muscle must be rested and re educated from zero. Its recovery must be along biological lines—that is, along the lines of the acquisition of its mammalian function.

Stimulated by the work of the Liverpool School of Orthopaedics, much research work has been carried out on the evolution of muscular function throughout the mammalia so as to form a scientific basis for muscle re-education. Furthermore, in cases of muscle transplantation to strengthen the weak, or muscle lengthening or division to weaken the strong, it is important to remember that certain muscles in the economy are "survival results," and that by the comparative method we are enabled to estimate the relative value for grafting—for example, of the two peronei or the two tibials, or the brachio-radialis.

In connexion with military orthopaedics it should be remembered that Thomas first introduced three simple methods of treatment which are now universally recognized.

He taught us that spinal curvature was frequently associated with inequality of length of limb, and that an essential in treatment was to raise the boot on the shortened side.

Inflammation of the metatarso-phalangeal joint of the toes, especially the great toe, to which soldiers are liable, can be relieved by a piece of hoop iron or leather "so placed under the shoe sole that its front margin is just under the joint, so that in marching the toes miss concussion with the ground as the patient advances the opposite foot."

The Thomas boot for flat-foot, with the oblique heel and the raised sole and heel on the inside, is well known. By its means strain is thrown off the inside of the foot, the tibial muscles are given a chance to strengthen, and the tendency to displacement of the internal cartilage of the knee to which these subjects are liable is obviated.

I have dealt at some length on the principles of Thomas because, although principles of rest were enunciated by Brodie and Hilton, he was the first not only to enunciate doctrines of conservatism but also to offer simple mechanical means by which these could be put into practice, although at his death his work was largely overshadowed by the operative system owing to the introduction of antiseptics. Thomas fortunately was succeeded in his practice by Robert Jones, who had the rare privilege of having worked with the master himself during the later years of his life. Thanks to him Thomas's work has been widened in its application, numerous improvements have been introduced, and scientific workers have been attracted to Liverpool from all parts of the world to learn those conservative principles which, like Thomas, he has always taught as forming the foundation of surgical practice. Thus in appointing Colonel Robert Jones, C.B., as Inspector-General of Military Orthopaedics, the War Office placed the treatment of the deformed soldier under the control of one who, himself trained in the modern aseptic school, is recognized as the greatest living exponent of the conservative method. In him the complemental schools of British surgery have been effectively combined. The British soldier who has suffered division of a nerve is assured not merely of a successful aseptic operation of suture, but of prolonged conservative treatment directed to the scientific stimulation and re-education of the affected muscles. Should these methods be unsuccessful, recourse may be had to the operation of muscle grafting, by means of which a flexor is asked to act as an extender and an extender as a bender as the result of alteration of muscle insertion.

A fractured bone, even if union be delayed, may be treated by various methods of conservatism, but should these fail resort may be had to the operative methods of pegging, bone grafting, and plating, for the advance in which department of surgery the profession is under a debt of gratitude to the genius of Sir Arbuthnot Lane. Should the femur be shortened it may be re-fractured and lengthened by the assistance of the abduction frame of Robert Jones. Joints, should they be deformed, are not forcibly torn down or excised, but gradually reduced, so that recovery in one set of muscles is always correlated to that of the opponents. By anatomical rest of joints and bones amputations of limbs are obviated; the soldier with a displaced fibro-cartilage of the knee, the replacement of which is always easy and usually spontaneous, is rested so as to allow rupture of the collateral tibial ligament on which it largely depends to repair, and when the patient resumes walking his boot is built up on the inside to prevent recurrence by relieving strain on the inside of the knee. Only in cases of recurring displacements due to an unrepaired collateral ligament is resort had to removal, which, as described by Robert Jones, is almost a minor operation. By means of the Thomas boot and simple manipulative measures the soldier with even a severe flat-foot can be treated successfully without operative interference which is reserved for extreme cases.

What a difference in the lot of the British soldier, treated in 1815, after Waterloo, by Sir Charles Bell, admittedly the greatest anatomist and surgeon of his time, compared with the treatment of 100 years later! It is hard for us to realize that Bell in his paper was dealing with scenes of only a century ago. In this short period of time, thanks largely to the genius of our countrymen—although we render homage to the names of Lavoisier, Lamarck, Cuvier, and Pasteur—the antiseptic system, anaesthesia, the conception of vaccine treatment, the placing of the physiology of nerve and muscle on a sound basis, the publication of the

Origin of Species, and the establishment of conservative surgical principles, have all been introduced. Without these no modern orthopaedic work would be possible. To these we must add *x* rays; and although we pay respect to Roentgen for his great discovery, we must always remember that the Crookes's tube was discovered in this country. We can recall with no little pride that these great discoveries have been freely given to the world for the benefit of humanity.

PART II.—STATEMENT AS TO MILITARY ORTHOPAEDIC HOSPITALS IN GREAT BRITAIN AND THEIR EQUIPMENT.

Orthopaedic cases comprise in one form or another a large proportion of the men invalided from abroad with severe surgical injuries.

Military orthopaedic cases are hold by the Army Council to include the following:

(*a*) Derangements and disabilities of joints, simple and grave, including ankylosis.

(*b*) Deformities and disabilities of feet, such as hallux rigidus, hallux valgus, hammer toes, metatarsalgia, painful heels, flat and claw feet.

(*c*) Malunited and ununited fractures.

(*d*) Injuries to ligaments, muscles, and tendons.

(*e*) Cases requiring tendon transplantation or other treatment for irreparable destruction of nerves.

(*f*) Nerve injuries complicated by fractures or stiffness of joint.

(*g*) Certain complicated gunshot injuries to joints.

(*h*) Cases requiring surgical appliances.

These cases naturally fall into two groups—those whose disablement is only temporary and who after treatment will be fit for military service again, and those who are so disabled that they must inevitably be discharged from the army.

The wounded soldier receives immediate treatment in a general military hospital. If his case comes into the category of orthopaedics, as defined above, he is then transferred to one of the orthopaedic centres for special treatment.

If his disablement has been only temporary, he may be sent for after-treatment to a command dépôt until ultimate recovery and return to military duty.

Command Dépôt.

A command dépôt is officially defined as a convalescent camp equipped with facilities for electrical and massage treatment under medical direction, but mainly organized and controlled under purely military officers, with the object of hardening men by suitable exercises and graduated drill for return to active service at the front in a period of about six months.

The men live in huts. Beds are wooden forms with straw palliasses and military blankets. Ordinary diets only are given. The huts are heated by stoves.

The cases suitable for admission to a command dépôt are:

1. Men recovering from gunshot wounds not involving joints or nerves.
2. United nerves giving normal action to muscles.
3. Pott's fracture, Colles's fracture, with no ankylosis of joints.
4. Injuries to left hand not to such a degree as to prevent the use of a rifle.
5. Simple myalgia without obvious organic symptoms.

All scars should be firmly healed and not situated at points of regular pressure of equipment, for example, shoulder, scapula, waist.

Spinal injuries when there are resultant symptoms as headache or paresis; shell shock with the slightest tremor or mental impairment; paralysed limbs, drop foot or hand, and neuritis, are not considered suitable cases for admission.

The command dépôts are visited regularly by an orthopaedic surgeon, to help the staff in their choice of cases for orthopaedic treatment.

List of Command Dépôts in the United Kingdom.

Name of Command Dépôt.	Accommodation for Men under Treatment in Addition to Permanent Staff.	How Allotted.
Shoreham	5,000	Eastern Command.
Seaford	5,000	London District R.E.
Sutton Coldfield...	2,000	Southern Command.
Ballyvonare ...	4,000	Southern Command.
Tipperary	4,000	Irish Command and Eastern Command.
Randalstown ...	3,500	Scottish Command.
Ripon North ...	6,500	Northern Command R.A. (Regular and I.F.); Machine Gun Corps.
Alnwick	3,400	Northern Command.
Knowsley Park ...	4,000	Western Command.
Heaton Park ...	4,700	Western Command.
Eastbourne ...	2,000	Cavalry whose Reserve Regiments are in the Eastern, Southern, and Aldershot Commands; Yeomanry whose 3rd Line Units are in the Eastern Command, Army Cyclist Corps; South African Contingent.
Blandford	600	63rd (Royal Naval) Divisions (only).
Ampthill	877	For Infantry (Regular and I.F.) whose dépôts are situated in No. 9 District, preference to Bedfordshire soldiers.
Total beds ...	45,577	

The soldier who is permanently disabled and utterly unfit for further military service undergoes similar treatment in the general and orthopaedic hospitals, and is finally discharged and pensioned.

Curative Industries.

In each orthopaedic centre, besides surgical operations, massage, electrical treatment, hydrotherapy, and gymnastic exercises, a series of curative workshops have been established with successful and valuable results.

These curative industries serve a twofold purpose. First of all—and this is most important—they are directly curative by giving exercise, under the surgeon's control and supervision, to the affected part. They are also indirectly curative through their profound psychological influence upon the patient. Apathy and inertia are replaced by bodily and mental activity. In the second place, these industries enable a certain number of the men to acquire a craft or trade, by which they will become more valuable to the community by the increase of their wage-earning capacity after discharge.

A minor point that experience has shown very clearly is the monetary value to the institution of the work done, such as splint making, carpentering, painting, etc.

The curative workshops are an important evolution in the war. In each orthopaedic centre they form an essential part of the treatment, with local differences dependent on the character and staple trade of the district. For example, in Aberdeen a net-making industry has proved highly successful, and in Bristol basket making.

The permanently disabled soldier is not lost sight of after discharge from the hospital and the army. He then comes under the care of the Statutory (Pensions) Committee. He may be quite fitted for civilian employment, in which case he may at once resume his old trade or seek new employment. He may find a place in one of Lord Roberts's memorial workshops; or he may elect to undergo further training for a new craft or trade. The advantage of the establishment of curative industries in the orthopaedic centres becomes obvious. The technical schools of the country have placed their resources at the disposal of the Statutory Committee, and it is understood that arrangements are being made for the intensive education of suitable pensioners at these institutions.

When a man is transferred from a general hospital to a command dépôt it means that his disability is temporary, that he belongs to Group 1, and that he is considered likely to be fit for active service within six months. If, on the other hand, he is transferred from a central hospital to an orthopaedic hospital he may belong either to Group 1 or Group 2. If to the former, his disability must be necessarily more severe than that of the man sent to a command dépôt, and the treatment required to fit him again for active service may of necessity be prolonged. If, however, he belongs to the latter, Group 2—if, that is, the medical authorities of the central hospital decide that his disability is such as to prevent him from ever becoming fit for any form of military service owing to the fact that he suffers from such a lesion as, for example, severance of the right sciatic nerve with foot-drop, he may also be sent to an orthopaedic hospital. If there were always available beds at orthopaedic hospitals these patients could be automatically transferred there from the central hospitals without delay, but the length of time involved in the treatment of patients at orthopaedic hospitals of necessity greatly lessens the number of new patients that can be admitted in any one year. The length of stay of the individual is prolonged, and at present this is a very real difficulty; because of this lack of accommodation at orthopaedic hospitals men may have to be brought before invaliding boards and discharged from the service at central hospitals who still require to begin skilled orthopaedic treatment. The fact, however, that a man has been discharged from the army does not prevent him from attending an orthopaedic centre as an out-patient or from subsequently being admitted for further treatment to an orthopaedic hospital, but it is a break in the logical sequence of treatment. Among this class of case may be patients with injuries of the musculo spiral, median, and ulnar nerves, and hemiplegias after head injuries.

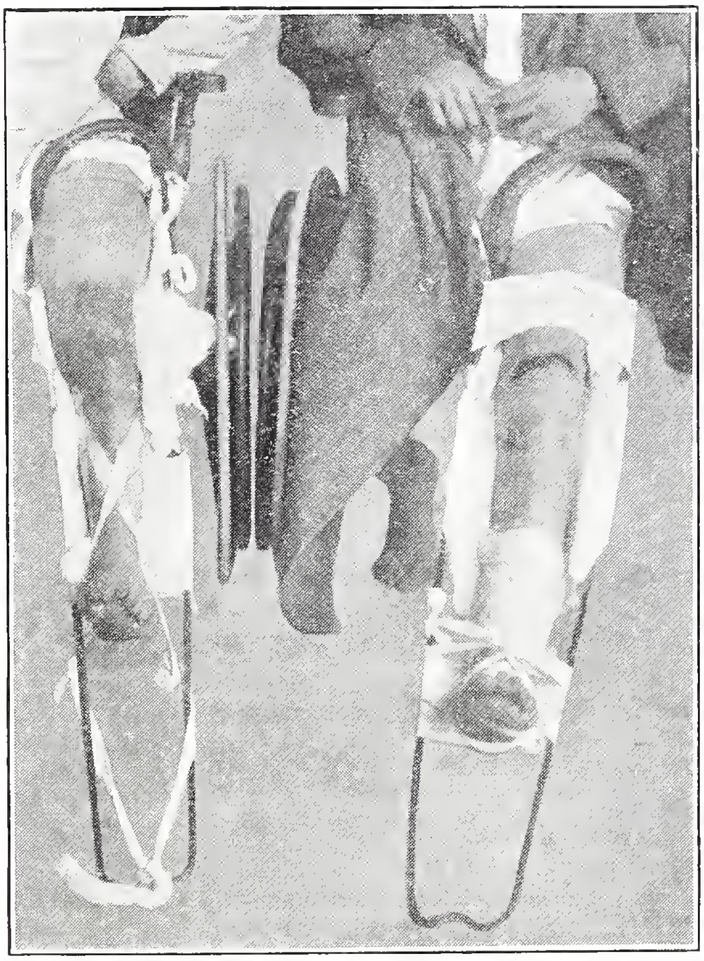

FIG. 9.—Patients returning from France suffering from gunshot wounds of the knee rested in Thomas's "bed" knee splint.

This difficulty is being met by the establishment of more orthopaedic centres and special annexes, but the numbers of beds will have to be very large, for these cases are a numerous and growing class. At present the War Office allows any discharged soldier disabled by the war to obtain further treatment at a military hospital, if he requires it, and these men can always seek out-patient treatment at a military orthopaedic centre or hospital; but here again we are faced with the difficulty that they may not live within several miles' walking distance and cannot, therefore, obtain treatment. Recognizing our debt to these men and their future value to the State, it is essential that skilled orthopaedic treatment, based on a scientific knowledge of the principles of surgical rest and of the anatomical and biological methods by which recovery of muscular function can be obtained, together with the mechanical training necessarily accompanying these, should be made available for them. Disabled soldiers fall obviously into two classes: (1) Those who are wholly permanently disabled for any kind of work; (2) those who may by re-education be restored to social and professional efficiency in varying degrees. The recognition of what patients constitute class (1) can only be left to skilled orthopaedic surgeons and be based on the principles above enunciated. How to best treat those comprising class (2) is the present urgent question, but enough has been said to show that the problem, at least from its medical side, is being energetically and adequately grappled with.

I must especially thank Major C. V. Mackay, M.D., R.A.M.C., of the King George Military Hospital, for numerous valuable suggestions and for his assistance in drawing up the plan on which this information is based.

Orthopaedic Centres in the British Isles.

There are now fully established ten orthopaedic centres in Great Britain and Ireland.

In England there are already four, of which one is at Shepherd's Bush. The other orthopaedic centres in England are: Alder Hey, Liverpool, the first to be formed, under Colonel Robert Jones; Leeds, and Bristol. It is proposed to found additional centres at an early date. In Wales the orthopaedic centre is at Cardiff.

Two centres have been established in Ireland, one at Belfast, one at Blackrock, Dublin. In Scotland there are three: Bangour near Edinburgh, Aberdeen, and Bellahouston, Glasgow.

The same general scheme of treatment is adopted in each centre under the supervision of Colonel Robert Jones.

It may be mentioned that each orthopaedic centre deals, in addition to the repair of deformities, with the preparation of the stumps of limbless soldiers before admission to Roehampton and other hospitals where artificial limbs are provided.

List of Orthopaedic Hospitals and Centres in the United Kingdom.

Military Orthopaedic Hospital, Shepherd's Bush, W. 1,000 beds.
National Orthopaedic Hospital, Great Portland Street, W.C. 170 beds.
Military Orthopaedic Hospital, Alder Hey, Liverpool. 850 beds.
Welsh Metropolitan War Hospital, Whitchurch, Cardiff. 500 beds.
Beaufort War Hospital, Fishponds, Bristol. 500 beds.
2nd Northern General Hospital, Beckett's Park, Leeds. 250 beds.
Bellahouston Hospital, Glasgow. 400 beds.
Bangour Hospital, Edinburgh. 400 beds.
Oldmill Hospital, Aberdeen. 250 beds.
Belfast U.V.F. Hospital. 300 beds.
Dublin. 200 beds.

The Military Orthopaedic Hospital, Shepherd's Bush, London, may be described as typical of all the centres. It is fully equipped, and has a visiting and resident medical staff. It is under the personal supervision of the Inspector, who visits weekly. The number of patients admitted from the opening of the hospital on March 1st, 1916, to February 28th, 1917, was 2,870, and the number discharged 2,101.

The following list of the discharged patients is important as showing the beneficial results of treatment:

	1. Duty.	2. Command Dépôt.	3. Re-classification.
1916.			
March	2	5	—
April	14	14	4
May	14	16	8
June	9	27	11
July	36	17	12
August	24	29	21
September	20	41	14
October	46	55	26
November	27	62	25
December	19	57	18
1917.			
January	34	27	16
February	17	32	26
	262	382	181

The majority of the patients under Class 3 (re-classification) were able to undertake mild forms of military duty, thus relieving fitter men for active service.

In reference to discharged patients it is important to bear in mind that owing to more rigid army regulations the discharge of men from the army to civil life as "unfit for further military service" has recently been considerably curtailed.

Apart from the question of available beds, there is no difficulty about the admission of a discharged soldier into this hospital for further treatment. On March 1st, 1917, the number of discharged soldiers in the hospital was 50, and there were 10 out-patients.

Electro-therapeutical Department.

This department is under the supervision of Captain Rowley Bristow, R.A.M.C., F.R.C.S. During the period July, 1916, to March 1st, 1917, the number of treatments given in the department was 19,000, and the number of new patients dealt with 728.

Type of Case.—The cases dealt with were mainly:

1. Peripheral nerve injuries.
2. Stiff joints with muscular wasting.
3. Atrophy of muscle.
4. Adherent and painful scars.
5. Functional conditions.
6. Trench feet and allied conditions.

Staff.—The staff consists of fourteen trained masseuses A.P.M.C. working under the direction of a surgeon in charge.

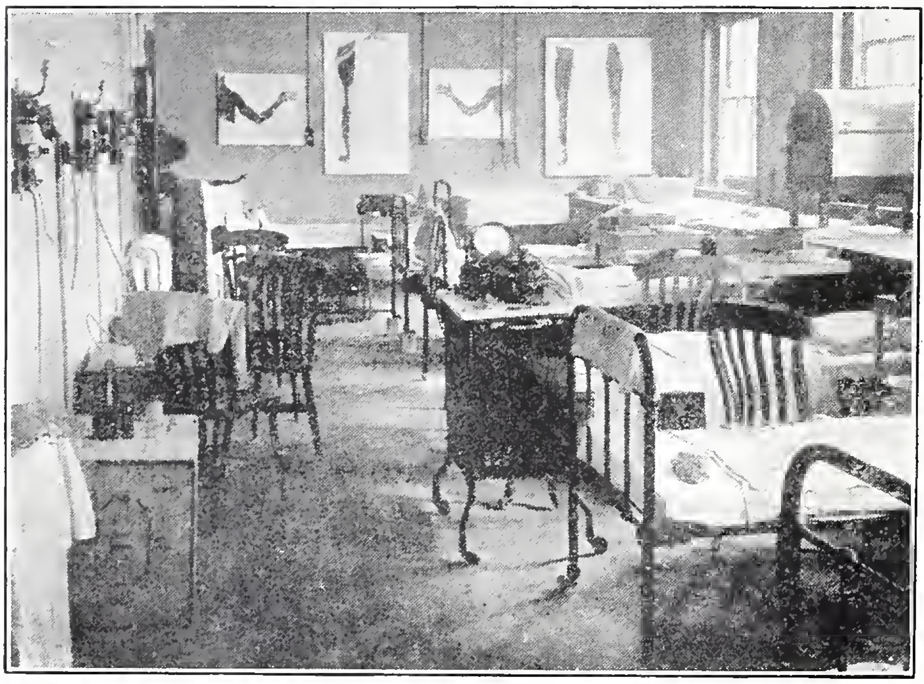

FIG. 10.—Interior of department for electro-therapeutics.

The electrical treatment of muscle is largely carried out by a specially wound faradic coil introduced by Captain Bristow. This coil is arranged so as to yield a current which is as nearly as possible painless, and which is under the control of the operator, so that the intensity of the stimulus can be altered from moment to moment. Rhythmical graduated contractions of muscle are brought about by this method. The muscle to be treated is made to contract gradually from zero to the desired maximum, and then allowed to relax. It is allowed to remain fully relaxed for a second, and then again stimulated. The left hand of the operator grasps the muscle and appreciates the degree of contraction, whilst the right controls the intensity of the stimulus. In this way the exact degree of contraction desirable for each muscle or muscle group is obtained. The control by hand is essential for the most efficient method of working, and no motor-driven or other form of mechanical interrupter can replace this control efficiently. With trained operators there is no risk of muscles being stimulated to the extent of causing fatigue, and so retarding progress. The main differences between this coil and the ordinary faradic coil are:

The special coil has thick wire in both the primary and secondary windings, and the number of layers in the secondary is less than in the primary—5 : 3. The interrupter can be exactly regulated by a sliding weight. A condenser of appropriate capacity is placed in circuit, to damp out the spark and assist in reducing the "skin effect" to a minimum.

The intensity of the stimulus is varied at will by (1) using either one, two, or three layers of the secondary; (2) by pushing in or withdrawing the soft iron core in the primary.

Massage.

The massage department is under the supervision of Dr. J. Mennell, and is equipped with all modern appliances for mechanical treatment. There are twenty-three trained assistants in the department — namely, twenty-one masseuses and two masseurs.

The number of patients treated and discharged from March, 1916, to March, 1917, was 863. On March 1st, 1917, the number of patients under treatment was 280. The average number of weekly treatments is 1,680.

Gymnasium and Hydrotherapy Department.

A large gymnasium is now in course of construction, to which patients will automatically pass from the massage department. The plans for a hydrotherapy department have been completed, and a building will shortly be placed under construction. Both these departments will be under medical control and in the immediate charge of trained instructors.

The Curative Workshops.

The curative workshops are of utmost importance. In these workshops the men are given a definite, regular, and interesting occupation, and energy instead of being wasted is directed to serve some useful purpose. These workshops, which are under the personal supervision of Mr. Poate, owe their existence to the energy and foresight of King Manuel, who has not only devoted his valuable time to those at Shepherd's Bush but has also superintended the erection of similar ones in other orthopaedic centres throughout the United Kingdom. The men working are employed as follows:

Employments in Curative Workshops.

Splint makers, smiths, engineers	25
Carpenters	10
Tailors (abdominal belts, surgical slings) ...	8
Bootmakers (surgical boots, repairs)	5
Fretworkers (men with dropped feet)	3
Leatherworkers (blocked leather splints) ...	4
Electricians, plumbers, and ironworkers ...	7
Masons (repairs in hospital)	2
Grindery (instruments used in operating theatres)	2
Wood choppers (sawing and chopping firewood for use of hospital)	9
Cigarette makers	7
Office and stores	4
Draughtsman	1
Orderlies and fatigue party (errands between different departments, keeping yard and shops clean, taking completed work to different wards)	11
Painters (painting splints and general work in hospital)	8
Total	106

In addition to this special work, over 300 have occupations allotted to them.

Return showing Number and Value of Splints Made in Orthopaedic Workshops.

Week ending—		£	s.	d.
October 28th, 1916 ...	... 35 ...	5	3	0
November 4th ,, ...	... 49 ...	7	14	6
,, 11th ,, ...	... 75 ...	17	3	9
,, 18th ,, ...	... 64 ...	9	11	6
,, 25th ,, ...	... 86 ...	12	9	0
December 2nd ,, ...	... 21 ...	11	2	6
,, 9th ,, ...	... 23 ...	13	16	0
,, 16th ,, ...	... 67 ...	14	18	0
,, 23rd ,, ...	... 26 ...	14	11	6
,, 30th ,, ...	... 29 ...	8	19	0
January 6th, 1917 ...	... 43 ...	12	8	0
,, 13th ,, ...	... 70 ...	20	12	0
,, 20th ,, ...	... 55 ...	19	1	0
,, 27th ,, ...	... 133 ...	34	0	0
February 3rd ,, ...	... 122 ...	27	9	0
,, 10th ,, ...	... 91 ...	30	0	0
,, 17th ,, ...	... 55 ...	19	17	6
,, 24th ,, ...	... 81 ...	17	16	6
March 3rd ,, ...	... 106 ...	31	4	6
,, 10th ,, ...	... 139 ...	34	4	2
Totals	... 1,371	£362	1	5

Total number of splints made from October 28th to March 10th, 1,371.

Cash value at pre-war prices, £362 1s. 5d.

Of the above returns 1,013 are stock pattern splints, namely, cock-up splints, gutters, club-foot shoes, crab (long and short), Turner's arm, whole hand-splints. The balance (358) are special splints designed in workshops, and made to surgeons' instructions.

Quantity of Orthopaedic Repairs by the Bootmaker.

The total number of cases requiring orthopaedic repairs by the bootmaker from October 21st, 1916, to March 4th, 1917, was 361. This was apart from ordinary repairs. The work consisted of inside and outside elevations, T-straps, cork soles, bars on soles, crooked heels, surgical boots and alterations according to medical orders.

Painting, Drawing, Photographic Department.

This department is under the control of Mr. Bird, the distinguished artist, who is assisted in photography by Mr. Lewis. Here not only photographs and drawings of cases during the various stages of treatment and splints used are made, but actual paintings in natural colour whenever the surgeon thinks it necessary. In this way can be kept complete records of operation cases, which are especially valuable in demonstration for teaching purposes.

X Rays.

This department is fully equipped with all the latest methods for *x*-ray photography under the supervision of Captain Keys-Wells, R.A.M.C., who attends the hospital daily.

Plaster Department.

This is under the charge of Sister Hurch, formerly of St. Bartholomew's Hospital, who has, as chief assistant, Private Wilde. Casts are made of all deformities admitted and permanent records can be kept of cases before and after operation. In addition to plaster jackets for support and plaster splints, casts are made of limbs and other parts on which splints, both leather and steel, are moulded so as to ensure accurate fitting when finished.

Artificial Limbs.

In association with the question of military orthopaedics it is important to remember that at Roehampton Hospital for Limbless Soldiers all cases of amputation are being provided with suitable artificial limbs at the expense of the State.

I am largely indebted for information relating to the Shepherd's Bush Hospital to the courtesy and assistance of Major Jenkins, R.A.M.C., Officer in Charge, Captain Hill, R.A.M.C., Registrar, and Mr. Poate, Director of Workshops.

The medical staff is to be congratulated in having converted within a week what was formerly an infirmary into a modern orthopaedic hospital.

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ARTIFICIAL LIMBS.

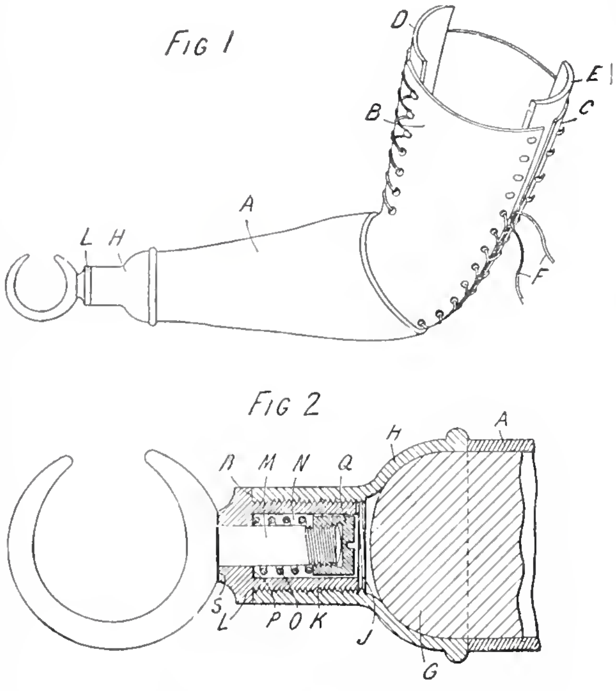
A FEW words may be added to the last paragraph of Dr. Colin Mackenzie's article to explain the organization brought into existence for providing men who have undergone amputation with artificial limbs. After the completion of his treatment in a general military hospital such a man often requires special treatment for some condition of the stump which prevents the immediate adjustment of an artificial limb; among such conditions are persistent sinuses, bulbous nerve ends, adhesions limiting free movements of a joint, and flexion of a joint by contraction of scar tissue; in some other cases re-amputation is necessary in order to obtain a suitable stump. Such men are sent to the Pavilion Military Hospital, Brighton; the Alder Hey Auxiliary Hospital, Liverpool; the Scottish Red Cross Hospital, Bellahouston, Glasgow; the Edinburgh War Hospital, Bangour; or the Welsh Metropolitan War Hospital, Whitchurch, near Cardiff. After the completion of their treatment in these intermediate hospitals they are sent to be fitted with the artificial limb to special hospitals—Queen Mary's Hospital, Roehampton, near London; Erskine House, Glasgow; Edenhall Hostel, Kelso; the Prince of Wales Hospital at Cardiff; the Ulster Volunteer Force Hospital, Belfast; or the Duke of Connaught's Hospital at Bray, co. Wicklow. Other hospitals for the same purpose are being established at Leeds, Manchester, and Liverpool.

For the most part all artificial limbs are made in workshops attached to these hospitals, and the man, before being discharged, is practised in their use and any defects discovered adjusted. It is intended that these hospitals, or some of them, shall be permanent institutions to which men can at any time return for the repair or refitting of their artificial limbs. Steps are being taken for the standardization of artificial limbs, and the branch of the Ministry of Pensions concerned with their supply and renewal has formed a collection at the Royal Hospital, Chelsea.

AMPUTATIONS OF THE UPPER LIMB.

Many trades are open to a man who has lost a lower limb or even both, but the choice of a man who has lost an arm is more limited, and if he desires to engage in manual labour, such as agricultural or mining, he needs a prosthetic appliance which will stand rough work.

An appliance for amputation through the forearm which is considered by experts to be one of the best and most practical yet devised for such men is the invention of Mr. Thomas Williams, who, when working in a Welsh mine forty years ago, met with an injury for which he had to undergo amputation of the right forearm four inches below the tip of the olecranon process. After many experiments he made a hook arm for himself, which has enabled him to earn his living as a collier, a mechanic, and in other ways. The construction of the limb is illustrated in the diagram, which is taken from the patent specification. The forearm, A, is made in one piece of stout or stiff leather, and the casing for the upper arm is formed in two pieces, B, C, of soft or pliable leather attached to the forearm. These pieces are eyeletted and laced together, so as to clasp the upper arm, soft tongues, D, E, being provided under the laces, F, if desired. This arrangement, besides giving more comfort, renders it possible in most cases for the wearer to attach the appliance in position without assistance. Within the wrist of the forearm casing is a block (G, Fig. 2) of wood or other suitable material, over the outer part of which is firmly fitted and secured a dome-shaped metal cap or holder, H, having a central hole or socket, J, screw-threaded internally. A correspondingly threaded plug, K, provided with an outer flange, L, is adapted to screw into this socket. This plug is centrally bored so that the shank, M, of the C-shaped hook can freely pass therethrough. The part of the bore nearest to the arm has an enlarged part, N, similar to a stuffing-box, to receive a spring, O, which is coiled around the end of the shank when placed therein. This spring is compressed between abutments formed by the shoulder, P, in the plug, and a nut or cap, Q, which is screwed on to the end of the shank, and is small enough to enter the space N. The plug, K, is then screwed into the socket, J, until the flange, L, meets its seating, R, and the appliance is ready for use. The hook, with its shank, M, is free to revolve axially in the plug, K, after the latter is screwed home, but is prevented from doing so too freely owing to the friction on the ends of the spring and between the base of the hook and its abutment, S. When a sudden pull comes upon the hook, the spring is further compressed and lessens the jar. Dr. W. L. Griffiths of Swansea, in demonstrating this appliance to a local meeting of the British Medical Association, said that the chief points of interest were the shape and action of the hook and the mode of attachment to the stump. The hook was convenient for using tools, for lifting, and for pushing. The attachment of the artificial limb by means of soft leather flaps laced round the upper arm, taking their grip above the condyles of the humerus, allowed free movement of the elbow-joint. The experience of the inventor, who has been using the arm for forty years, showed that there was no risk of pressure sores; the skin was freely movable over the deeper tissues, and it was not appreciably thickened. Mr. Williams could use a pick and shovel, could lift a weight of 56 lb., could swing a 14 lb. sledge hammer, could use a scythe, could plough, could pitch hay, and do any other work of an agricultural labourer, and could work as a collier, a mechanic, and a carpenter.



The Williams Welsh Arm.

A Table for Armless Soldiers.

The condition of a man who has undergone amputation of both upper limbs is still more unfortunate than that of one who has suffered amputation of both lower limbs. At the hospitals for limbless men many ingenious devices have been tested, and much has been done towards the standardization and simplification of prosthetic appliances for the upper limb. A table for the man in the unhappy position of having undergone amputation of both upper limbs, leaving stumps too short for the fitting of a satisfactory arm of the usual type, designed by Mr. C. A. Sheehan, has recently been approved by the Munitions Inventions Department of the Ministry of Munitions. It will enable the man to occupy himself during the absence of his attendant, and as he gains the necessary dexterity it should be possible for him to feed himself, perform various operations, and write. Fig. 1 is a front view of the table, and Fig. 2 a sectional view showing the arrangement of the turntable with its ball bearings and central leg, and of the sliding platform with its actuating lever. Fig. 3 is a plan view of the complete table. Figs. 4, 5, and 6 show details. The appliance is operated chiefly by the use of the legs and feet, with the occasional assistance of the head.

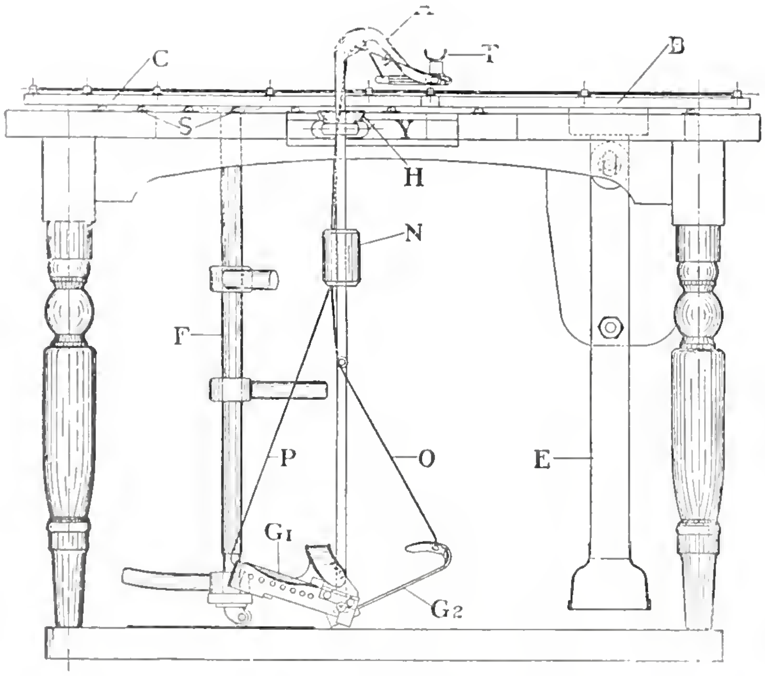


Fig. 1.

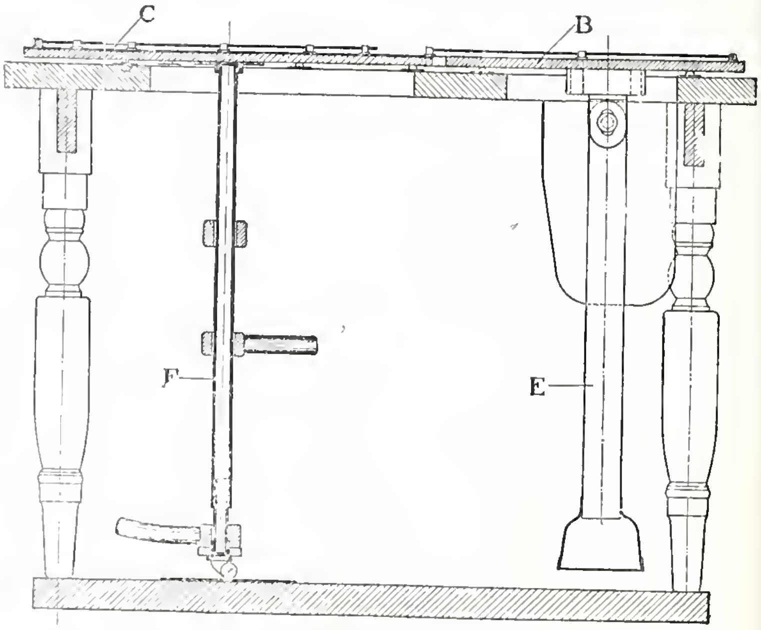


Fig. 2.

The operator sits in front of the table with the mechanical arm A before him, and is thus able to move the sliding platform B by means of the lever E, and the turntable C by means of the leg F, so as to bring objects on them within reach of the tongs, D, of the arm. The turntable C rests on ball bearings, S, and can thus rotate and also move slightly in a linear direction in the plane of the table. The tongs are controlled and the arm moved by the ball of the operator's foot, which is placed in one of the shoes G_1 or G_2; pressure on the shoe G_2 opens the tongs (which are normally held closed by a spring M and a weight N) by means of a flexible wire, O, passing over guide pulleys. On releasing the pressure on the shoe G_2 the sliding weight N falls and closes the tong jaws with sufficient grip for most purposes without any force being exerted by the operator. If, however, a specially strong grip is required, it is obtained by pressure on the shoe G_1, which forcibly closes the jaws by means of a flexible wire connexion, P, fixed to the weight N. The arm, which is a rigid, inverted L-shaped member, is universally suspended by a ball and socket joint H, so that by appropriate motions of the foot the arm can be twisted or raised in practically any direction. An article gripped in the jaws can thus be raised even to the top of the head of the operator. The ball and socket joint H, together with the arm A, can be moved slightly relatively to the table along a slide. Vessels and cutlery for use with the table require to be specially shaped or adapted in order that they may be firmly gripped by the tongs; for example, the cup (Fig. 5) is a conical vessel, and is gripped close to the bottom flange, and the knife J (Fig. 6) is held by the rubber-faced attachment K. A sheet metal attachment, R, is provided on the arm A for turning over the pages of a book, and for dealing with sheets of paper, and a shaped attachment, T, for a cigarette, etc., is provided. Fig. 4 shows a writing easel. The writing-pad is laid on the front face after having been folded round a wire frame, projections of which rest in the notches of the plates, so that the frame can be pushed up notch by notch as each line of writing is completed; the easel is hinged at the bottom and supported by a saw-toothed bar resting on a curved spring. Under the pressure of the pencil, which is held in the tongs, the easel yields slightly, and this movement facilitates the formation of the upstrokes necessary in writing.

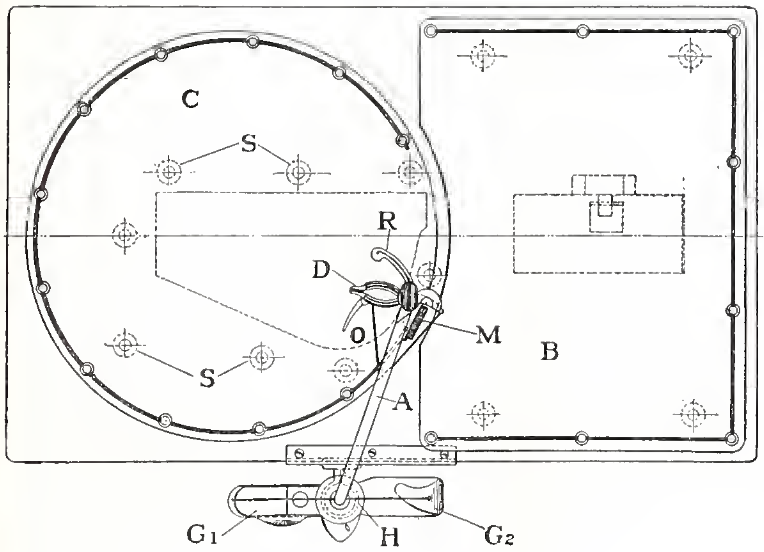


FIG. 3.

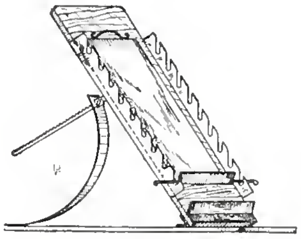


FIG. 4.

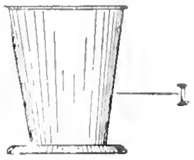


FIG. 5.

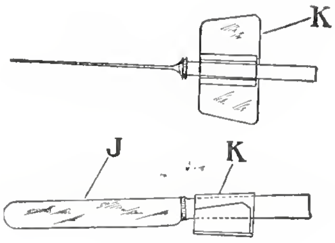


FIG. 6.

CHAPTER IX.

THE INVESTIGATION OF THE SIGNIFICANCE OF DISORDERS AND DISEASES OF THE HEART IN SOLDIERS.

BY

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DR. LEWIS'S Report on the work done at Mount Vernon on Disorders of the Heart[1] as seen in the soldier is so careful and complete that there is little, at present, to add to it, and the comments I am requested to make upon it can be but few.

One main result of the investigation is to strengthen the opinion which, before these researches were established, was gaining ground—namely, that "heart strain," a phrase a few years ago in common use and application, is a rare event. In the article on Stress on the Heart in Allbutt and Rolleston's *System of Medicine*, an article which expressed the opinions at that time of Roy, Michell, and myself, we likewise had affirmed that "for one case of disability due to strain, or even of sharp overstress, there are fifty of secondary and incidental derangement." And again: "As the animal mechanism attained many wider and more various powers of survival yet scarcely even a momentary independence of the heart, this organ must itself have attained to an enormous endurance, and resources almost illimitable." But in the same essay, under "Infections," I said that "stresses upon hearts under this detriment result only too often in (heart) strain . . ." "experience inclines me more and more to refer cases of heart strain to this category"; and I quoted Dr. Arthur Lambert of Harrow who "regarded (in 1904) the specific fevers as the determinant of heart strain in schoolboys; anaemia, general debility and lack of training being subordinate causes. Up to 1903," he added, "I was able to collect a number of cases of 'heart strain,' and during those years influenza was always with us. After 1904 we saw very little of heart strain." With acute cardiac dilatation after such obvious infections as of scarlet fever and diphtheria we are all familiar, and in the article from which I am now quoting I stated that even a "bad cold" might have some such consequence, if during the brunt of it excessive exercise were undertaken.

It was in 1903, when de la Camp's paper[2] came into our hands—a paper in which the author reported, rather to our surprise, that the heart, far from expanding during muscular effort, diminished in mean diameter—that, infection apart, we began to take a different view of cardiac conditions under effort; that, instead of working under dilating stresses, the heart under exertion is normally smaller. Yet had we considered cardiac physics more intimately, we need not have been surprised. It is true that in exercise beyond the capacity of the myocardium the blood is heaped up in and near the right heart at the gates of the lungs; and this the more when the individual is imperfectly trained, or is becoming stale. But as rate and velocity increase, and the periphery expands, the output per beat must be less; and therewith the cardiac diameter. Furthermore, as the heart has its own blood supply, blood runs round the heart many times for once round the systemic area.

The heaping up of the blood in the right heart and veins is heavier, and tarries longer, in the untrained. Training is something far more than dietetics and muscular exercise; in the circulatory concert it means a development of the thorax, an unfolding of the lungs, and a swifter interplay of vascular, nervous and chemical responses.

In former papers I have described how in the first few minutes of increased effort—for example on starting to climb a steep hill—the arterial tree, as represented by its radial branch, opens out, not gradually but suddenly; and the better the training the sooner this expansive readaptation takes place. Under this change—this great reduction of friction—it is intelligible that the diameter of the left ventricle should diminish, or the chamber empty itself more completely. But in a man growing stale under training the vasomotor mechanism loses its tone, and its responses are enfeebled. There is no better test of the "fitness" of an athlete than to draw the finger-tip sharply down his cheek, when, if he be "stale," the red line will be strong and persistent. In many cases of "D.A.H." at Mount Vernon this loss of vasomotor tone is conspicuous The hand when hung downward turns a duskier blue, and its vessels empty when it is held above the head. If the finger be pressed upon such a hand and removed the white patch is long in recovering its colour.

But the researches of Dr. Lewis and Mr. Barcroft at Mount Vernon raise quite a new and a very interesting problem: setting aside for the while poisoning of the myocardium, may incidental infections produce any other effects in which the heart is concerned? The answer appears to be in the affirmative. These researches (p. 19) seem to discover a new disease, or rather to discriminate more exactly the features and nature of a disease less clearly apprehended already, by Da Costa and others, as "soldier's heart"; or by those of us who have written upon "neurasthenia" as "cardiac neurasthenia." The disease is one which is not uncommon in the civil population; but under the stress of the soldier's training, and amongst the aggregations of men in modern armies, it is more conspicuous and inconvenient. It is of the kind of diseases known to our fathers as "*morbi sine materia*"—a disease without a lesion. "Disease" is a clinical not a pathological term, and consists in a series of symptoms recurring with a fair uniformity. At Mount Vernon I have been much impressed by the uniformity of the series now chiefly under consideration. It consists in the main of the following terms or symptoms:—submammary pain, palpitation and quickened pulse, shortness of breath on exertion, tremor, exhaustion, "dizziness," and certain vasomotor phenomena. This group of symptoms is too uniform to be fictitious or fantastic.

Now it will be seen from the Report that in these cases —in this disease—although not rarely an infection takes some place in the history, the heart is mechanically unaltered. I am glad to add my testimony to the great care and precision with which these mechanical appreciations were carried out; the orthodiagraphic observations of Major Meakins and his colleagues being especially diligent and valuable.

The outcome so far then is that the fretful heart, known as the "soldier's heart," is not cardiac strain; and, whatever the explanation may be, for this I refer to the Report, there is this gain to nosology—that although, in the past, heart strain and what for temporary convenience I may call still "soldier's heart" have been confused, and even classed together, this disorder and that are now made separate and distinct. For "soldier's heart" we need a better name, and, if it is to be Greek, I have suggested ponopalmosis, a compound word which means palpitation on effort. Therefore, with a few chance exceptions, from the Mount Vernon category "heart strain" is dismissed.

Now by this selection I do not mean that heart strain does not occur; but that it is generally a result of some infection, is relatively infrequent, and does not constitute the bulk of the cases invalided from the army as "D.A.H." (see Report, p. 54 f.). With the gradual and inevitable deterioration of the myocardium after maturity—say in man from the age of 35 to 40 onwards—I have not now to deal. I have discussed this grave question in my *Diseases of Arteries*.[3] At Mount Vernon nearly all the patients are under this period of life. This is one, and the first in importance, of the principles obtained under Dr. Lewis's research and direction. In the article referred to in the *System* on Overstress of the Heart the two classes of cardiac disorder were more or less confused; the cases which Roy and I and Michell studied were, many of them, it is true, cases of actual heart strain; but effects for the most part, if not in all instances, brought about under the influence of some infection. Moreover, in them the heart, the right side of the heart usually, was definitely dilated and the valves for a while often incompetent. In "D.A.H." the form of the heart is unaltered and the dyspnoea seems not to depend directly upon the heart.

Here however I would venture on some demur to the disrespect with which certain cardiac murmurs have been treated by Sir James Mackenzie—to whose researches we are all so deeply indebted—and by his disciples. This is an extreme reaction against the obsequious regard for these signals which not unnaturally prevailed in the generations immediately after Laënnec. It is true that in concluding "that the presence or absence of murmurs (wherever they may be audible) is of no value in estimating the soldier's capacity for work" Dr. Lewis premises that he concerns himself only with the capacity of a man for military service for a subsequent period of undefined duration. This I agree is true; under my care at this moment is a man, aged 32, suffering from mitral regurgitation, now to the degree of large dropsy and dyspnoea, and in a condition beyond substantial remedy. He had rheumatic fever at the age of 6, and was then told that his heart was affected. But thereafter nevertheless for some twenty years or more he had been at work as a labourer. Last year I had a similar case in a man who, after rheumatic fever, with damage to the mitral valve reported at that time, had notwithstanding been occupied since as a coal-heaver for sixteen years; and for the while with impunity. Of such cases I think we must admit that though for many years the mitral regurgitant murmur had not indicated immediate physical incapacity, yet it did indicate cardiac disease, and sooner or later cardiac failure. That out of such a man the State may nevertheless get a few years' work, is a decision which at Mount Vernon we may very properly make without cynicism; as Dr. Lewis says, at Mount Vernon our business is only with capacity for farther service; still, as he admits, the diagnosis, or prognosis, is "open to criticism on academic lines";—that is to say, from the patient's point of view? And not the diagnosis only but also the rule of life.

Here may I remark that the phrase "back pressure," in common use even by expert writers on affections of the heart, is to me unintelligible. Surely by an increase of resistance in front the blood pressures must be raised in the whole area concerned; and equal in all directions, fore back and lateral. To students at any rate, not to mention some of their seniors, this fallacious phrase suggests that the blood stream is reversed! In the generation of many a loud murmur the regurgitant wave, in the strict sense of the word, may be very small; possibly none, as a fluid vein and turbulent collisions of the particles of the blood may be caused by changes in the relative diameters of the chambers only. Or again, like a stream from a tap which when turned slightly on may be noisy, but when "full on" almost inaudible, so the slenderest thread of regurgitation may make a loud murmur. Constancy in the degree and quality of a murmur, as it suggests stability of structure and compensation is therefore, on the face of it, a good sign. In all cases of definite systolic murmur at the apex I believe there is regurgitation, whether the condition be temporary or permanent. I see no other explanation of the change of linear into turbulent motion.

In the class of cases we are considering, functional "murmurs"—that is murmurs dependent upon transitory causes—are very common; and I think we are bound not to ignore them but to do our best to analyse them and discriminate between them. This I think is not so difficult a task as it is often said to be. On the one hand in the "soldier's heart," as Dr. Levy pointed out to me, a systolic murmur having its chief seat along the left costal arch is very frequent; one would guess it to be but a whiff of air expelled at each jerky heart stroke from the lappet of lung. So again in the healthiest young man we may hear a systolic murmur over the area of the pulmonary artery; by this idle noise, although usually due merely to a slight impingement of the vessel upon the wall of the chest, and of no importance, many a lad has been kept out of the football field. Let us first eliminate all these insignificant noises from the list, and then on the other hand concentrate our more serious attention upon murmurs dependent on altered mechanical states of the heart; though, as even these are often transitory, a farther subdivision is necessary.

And for the present let us leave out of reckoning murmurs about the base of the heart, and direct our attention to those referable to the mitral and tricuspid areas. Even when these are transitory, as for example during convalescence from an infection, it seems certain that when systolic they signify valvular disorder; the valve, or more probably, in transitory cases, its bed, is awry; and the patient, so long as the murmur remains, should be treated on this assumption. For a murmur signifies the existence of an abnormal fluid vein, and an abnormal fluid vein means abnormal friction, and friction is a waste of energy. A young, vigorous, and normal heart, with some readjustment, may afford to waste this energy—for a while; but a perpetual waste, in an organ whose reserve is so precious, cannot go on without ultimate harm. It is a handicap, and the efforts cast upon such a heart should not be immoderate.

In looking back upon many years of practice I recall very vividly, in respect of the present subject, the subsequent lives of many a patient in whom a mitral regurgitant murmur was for years the precursor of subsequent cardiac incapacity and ultimate failure. For the change from linear to vortex motion meant a fall in velocity, save in so far as the muscular structure of the heart at the part was buttressed. For many a year perhaps a young or comparatively young heart, out of its abundant stores, can meet excessive demands, and build itself up at threatened points; but if the interval is often a long one the event is none the less manifest. The murmur in crucial cases has been discovered accidentally; as for example in an examination for some temporary disorder, or for life insurance; though cardiac incapacity may not have ensued for years afterwards. After an uncertain period however the heart begins to enlarge, and the patient to feel a little transient dyspnoea on unusual effort; this symptom increases, and the heart begins to make itself felt; yet even thus the patient may live still for a few more years, and under due precautions do not a little work of a sedentary kind. It is then that effort tests may betray myocardial default, but the patient has then entered not upon his disease but upon the last stage of it. Then nocturnal dyspnoea will appear, the ankles puff up, and other symptoms of the final phase of the malady accumulate. Perhaps after this lapse of time I may refer to the first case of this kind of which I had any knowledge—that of my old master and friend Bence Jones. He bought a flexible stethoscope, then a novelty, and tested it first upon himself; unhappily a mitral regurgitant murmur made itself heard, and although this distinguished man lived on without suffering for a while, and in his impulsive way would still forget himself so far as to fly up the staircase at St. George's two steps at a time, yet gradually the increasing friction in the blood, and the consequent fall of velocity, made themselves felt, and brought about his premature death. Scores of such cases arise in my mind as I turn my eyes to the past; some of mitral regurgitation consequent upon an infection, some upon slow athero-sclerosis of the valve, and so forth. For, I repeat, an endocardial murmur means a fluid vein, an eddy; and an eddy means friction and a disturbance of linear motion; these, unless in some indifferent area, mean sooner or later a breakdown of the machine.

On one other point I would spend a few words—namely, on *latent mitral stenosis*. In consultation the question often arises whether or no in a particular case there is a murmur at the apex. "Murmurish," says one; another that the first sound is prolonged; another that the first sound is reduplicated, but no murmur. No "murmur," it is true; the added sound may not be murmuring nor whispering, but an addition to, or a hitch on the ordinary first sound. The first sound may seem divided, with a notch as it were, in the middle of it. Now the addition may be before or after the true first sound; in the latter case, sooner or later it murmurs more definitely, and betrays a mitral regurgitation. With this I am not now concerned; in the former case it is a sign of a mitral stenosis, slight in degree and "compensated." Now in this case a thrill—short perhaps, and narrow in area, but unequivocal—may, if carefully sought for, be detected. But in the absence of cardiac deformation, of definite murmur, and of proper symptoms, this thrill may not be looked for. These latent cases turn up in practice, civil or military, and, if not readily picked out, may be reckoned among "our failures."

As an illustrative example of latent mitral stenosis I may take the case of Mr. B., a patient of Dr. Johnson of

Cambridge whom I had seen some years before for neurasthenia with irritable heart, to which he was, and still is, liable. Dr. Johnson sent him to me, in respect of a call to military service, with a note of a faint and variable presystolic murmur. He had had rheumatic fever but with no record of cardiac affection. The first sound was short and snappy, but his heart had always been irritable, and on this visit I could not hear any murmur unless it were, for a beat or two after putting him through some exercises, a very fleeting presystolic sound—so fleeting as to be hard to define or record. The heart's dimensions were to percussion normal. While murmur hunting I forgot till the last moment to feel for a thrill; but then I found a short apex thrill clearly perceptible, and presystolic in time. Some ten days later I examined him again, and on this occasion a presystolic murmur was audible, brief and soft but decisive. Oddly enough, now the thrill had vanished; again and again I tried to find it but in vain. So capricious is this disease in its physical signs, and so elusive are its signs, in respect of military service or of life insurance. I am not as yet ready to accept a definite distribution of stenosis murmurs into early, middle, and late. Again, a young friend of mine, very active both in mind and body, and anxious to serve in the army, has been rejected on two occasions for "soldier's heart." He has a slight addition to the short first sound and a short presystolic thrill. He has never had rheumatic fever nor other illness.

We have had a complicated illustration of this phase in the Mount Vernon Hospital. With Dr. Wilson and another colleague I examined a man with the obvious signs of aortic regurgitation. The question arose whether or no a divided first sound, audible at the apex only, signified a reduplication of the first sound. This it scarcely seemed to be; the taps were too close and the first one too light and brief; but I thought I recognized in it such a split in the first sound as I have described. The carotid beat being, as usual in such cases, only too definite, we were able to conclude that the first tap of the duplex sound was presystolic. Following this up we detected a presystolic thrill, short and light but quite distinct.

A thrill must be very carefully placed and timed, for in many of these irritable hearts a systolic thrill can be felt; perhaps in most of them if some effort be made just before examination. It is short but often very distinct to the touch. It is not felt about the base of the heart, and is therefore not due to a slack aorta. How the thrill is generated it is not easy to say. Very often in these cases a systolic murmur at the apex is recorded, an alteration of the first sound, more like a prolongation of it with some change of quality than like a definite murmur of mitral regurgitation. To suggest the cause of this thrill is but to guess; but, if I may guess, my suggestion would be that in these cases the papillary muscles and their chords may be a trifle slack, so that the mitral sheets shiver a little in the current, as a sail shivers when the boat gets near the wind. Such a quaver would be transmitted to the ventricular wall, and thence to the thoracic. In such a condition there might well be a minute, inconstant, and insignificant regurgitation also; though ordinarily in mitral regurgitation there is no thrill.

In conclusion, I hope it may not be unbecoming in me as a member of the staff, but rather an onlooker than of effectual service, to offer my tribute of praise to the author of this Report; a brief summary of infinite pains, of his own and of those of his colleagues who are and have been on resident duty at the hospital.

REFERENCES.

[1] Medical Research Committee's Report upon Soldiers returned as Cases of "Disordered Action of the Heart," or "Valvular Disease of the Heart." Spec. Rept. Ser., No 8. [2] *Zeit. f. klin. Med.* [3] See C. Allbutt's *Diseases of the Arteries*, ii, 475.

CHAPTER X.

ON GUNSHOT INJURIES OF THE CHEST,

With Especial Reference to Haemothorax.

BY

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WOUNDS of the chest do not as a rule reach the bases in France until the fourth day after the infliction of the wound, except in periods of heavy fighting, then they may arrive much earlier, that is, on the second day. The observations recorded in this paper deal more especially with cases observed from the third or fourth day up to about three weeks after the occurrence of the injury, and thus they deal with only a portion of the subject. Gunshot wounds of the chest are usually divided into those penetrating and involving the lungs or other thoracic viscera, and the non-penetrating, although it is not always possible to be certain during life that an apparent non-penetrating wound is really such. Non-penetrating wounds may, however, give rise to pleural and pulmonary lesions, and in a certain proportion of cases of simple clean perforating bullet wounds of the chest the positions of the entry and exit wounds suggest that the bullet does not only pass through the chest but also through the lung, nevertheless there are no signs or symptoms indicating the presence of either air or fluid in the pleura, and such cases may recover rapidly and apparently completely. Pleurisy and empyema are the most common pleural lesions produced by wounds of the chest wall not involving the lung. The pleurisy is often at first dry, but not uncommonly an effusion follows, and since such lesions are often due to streptococcal infections spreading from the wound track in the chest wall to the pleura, an empyema of the usual type develops and requires the usual treatment.

Haemoptysis, haemorrhagic infiltration of the lungs, and pneumonia of a septic bronchopneumonic type are the pulmonary lesions that may follow on a wound limited to the chest wall. In addition to these, collapse of the lung of a massive type may occur on the side opposite to the injury even when the latter causes no pleural or pulmonary lesion on the side injured. The haemoptysis and the septic pneumonia are both directly associated with the bruising and consequent bleeding into the lung produced by the impact of the missile on the chest wall and the resulting injury to the chest wall and lung. The haemoptysis may not only be severe, but may also run a long course, and some of the most severe cases of haemoptysis seen by the writer in a very large series of chest cases were those in which the missile only bruised the chest and had not only not produced any wound, but where there was no evidence of any fractured ribs.

The bruised and blood infiltrated lung is very prone to become infected either from the lung or by the spread of infection from the wound track in the chest wall, and hence pneumonia of septic or of a bronchopneumonic type develops. In some cases wounds of the chest wall lay open the pleural cavity but do not involve the lung, a portion of the chest wall, more especially in its lower parts or at the back, is carried away and a gaping hole, often of considerable size, is left. In such cases the lung does not as a rule undergo complete collapse, although the pleural cavity is in free communication with the air. In fact, the volume of the lung seems to approximate to that seen after death when the pleura is open, and therefore the pulmonary collapse is markedly less than that seen in ordinary pneumothorax where, as is well known, very complete collapse occurs, yet in the latter cases the intrapleural pressure may not be above that of the atmosphere.

Penetrating wounds of the chest usually produce one or more of the following conditions: subcutaneous emphysema, haemothorax, pneumothorax, laceration of the lung. These conditions may not only arise where the wound is one obviously involving the chest, or where the wound of entry is near the chest—for example, the neck or the abdomen especially in its upper part; but wounds in other regions—for example, the face or arm—may also give rise to haemothorax or pneumothorax from the course of the bullet being peculiar owing to the position of the soldier at the moment he is struck. In such cases there is often only a wound of entry, and this may be small and inconspicuous, but yet a large haemothorax or even a pneumothorax may be present.

Further, in wounds of the chest the haemothorax or pneumothorax may be on the side opposite to the wound of entry; the missile taking an oblique course may enter on one side, more especially in wounds of the back, and follow such a course that it does not open the pleural cavity on the side of entry, although opening that on the opposite side without or with a wound of exit. Again, in some instances a bullet may enter and leave the pleural cavity on one side without causing any appreciable lesion on that side, and yet so wound the pleura and lung on the opposite side as to cause marked lesions.

Bilateral haemothorax is sometimes seen as a result of a single wound the track of which is transverse or oblique, and haemopericardium may occur in association with either unilateral or bilateral haemothorax.

Unilateral wounds, however, may cause bilateral effects owing to the development of contralateral collapse or contralateral pneumonia.

The subcutaneous or so-called surgical emphysema so often present in chest wounds is usually limited to the vicinity of the wound or to an area of the chest wall adjacent of variable size. In exceptional instances its distribution is more extensive, and it may sometimes involve not only the trunk but even the whole body, including the face and extremities.

Haemothorax.

Haemothorax is the most common result of a chest wound; both pneumo-haemothorax and pneumothorax are relatively rare, and in a series of 328 cases of gunshot wounds of the chest only 8 cases of the former and 4 cases of the latter were observed.[1]

The haemothorax may be either sterile or infected, and if the latter the infection may be either early or late. If early, the infection occurs within the first few days after the infliction of the wound, and is doubtless dependent upon infective material being not only carried in with the missile, but directly infecting the effused blood generally and rapidly. In such cases exploration of the haemothorax reveals the presence of organisms in the fluid withdrawn. Infection, however, may occur later, that is, in the second or third week after the receipt of the wound. Such cases may at first run the course of a sterile haemothorax, with but few symptoms, and the fluid removed by paracentesis may fail to show the presence of any organisms. Suddenly urgent symptoms, such as increasing fever, dyspnoea, pain, rapid pulse and jaundice, arise, and paracentesis then reveals the presence of organisms in the fluid withdrawn. The infection may be more or less localized, and more especially so in the lower portions of the chest, and in such cases paracentesis may yield different results according to the site explored; at one spot a sterile fluid may be obtained and at another at no great distance from the first a fluid of a totally different character containing abundant organisms. This is especially the case with anaërobic bacillary infections. It is probable that in many cases the explanation of the rapid development of the clinical picture of infection, in the course of what seemed for some days to be a case of simple sterile haemothorax, is to be sought in the fact that the infecting agent, that is, fragment of clothing, etc., was shut off by blood clot from the general mass of haemothorax fluid in the chest. Later, owing to the spread of infection through the clot, the haemothorax becomes infected as a whole, and hence the rapid development of urgent and very dangerous symptoms. In a series of 450 cases of haemothorax observed by Bradford and Elliott infection was present in 117—that is to say, roughly, in 25 per cent.; and Captain H. Henry, who carried out the bacteriological investigation, found that lung organisms such as the pneumococcus, *B. influenzae* and *M. tetragenus*, were present in some 20 per cent. of the infected cases, and that in the remaining 80 per cent. streptococci, staphylococci, and anaërobic gas-forming bacilli were found.

In approximately 50 per cent. of the infected cases anaërobic bacilli, either alone or in association with cocci, were present; hence it would seem that infection of a haemothorax is much more frequently derived from the skin or clothing than directly from the lung. In some instances the pleural infection arises from direct extension from the infected wound track in the chest wall, and such a mode of spread may lead to the development of pleural and pulmonary complications in cases of wounds limited to the chest wall, and not directly involving either the pleura or the lung.

Henry and Elliott[2] have studied the morbid anatomy of wounds of the chest in a series of 100 cases observed in hospital at one of the bases in France. These observations deal only with cases that succumbed from the third day to the third week after the infliction of the wound, and one of the most striking facts ascertained was, that within these limits of time, death from haemorrhage as a result of a wound of the chest was very rare. Thus, in a series of 78 fatal cases of simple haemothorax there were 70 in which either infection or an additional visceral complication, or both, were present. In the remaining eight cases, where death might have been due to haemorrhage, purulent bronchitis was present in three, and in four cases no record existed as to whether sepsis was present or not, thus leaving only one case in which haemorrhage alone could be definitely asserted to be the sole cause of death.

Septic infection is by far the most frequent, and therefore the most important, cause of death in cases of haemothorax that survive the first few days immediately following the wound.

Secondary haemorrhage is also extremely rare, and in this series of 100 fatal cases only three instances were recorded; in two cases the haemorrhage took place into the pleural cavity, and in one a fatal haemoptysis occurred from a vessel in the vicinity of a small abscess in the lung round a fragment of shell. The writer has only seen one other instance of fatal haemoptysis due to secondary haemorrhage in the course of observations on many hundred cases of gunshot wound of the chest, and here also it was due to the lesions produced by a fragment of shell embedded in the lung.

The more important points in the morbid anatomy of haemothorax are the following: The degree of collapse of the lung, and especially of the lower lobe, is very marked, and would seem often to be greater in amount than that usually seen in pleural effusions. The over-distension and so-called emphysema of the upper portion of the lung above the fluid is certainly far greater than that seen in cases of pleural effusion. The anterior part of the upper lobe of the lung is frequently pressed up against the chest wall, and the anterior margin of the lung frequently extends beyond the middle line. There may be a line of loose fibrinous adhesions gluing the surface of the lung to the chest wall at the upper limit of the effused bloood. The parietal pleura in the area corresponding to the effused blood is coated with a layer of fibrin one-eighth to one-quarter of an inch thick, and the surface of the collapsed lung is similarly covered to a greater or less extent with a layer of fibrin. The collapsed lung on the side of the haemothorax rarely, if ever, presents signs of inflammation except in the immediate vicinity of the wound track in the lung or round any retained foreign body. Pneumonic consolidation is not found in the lung beneath the haemothorax. Purulent bronchitis may be present not only in the contralateral lung but also in the emphysematous portion of the lung on the side of the haemothorax, but above the fluid. The great collapse of the lung would seem to be not only a safeguard against further haemorrhage in cases where the lung is wounded, but also a very efficient protection against the development of inflammatory complications. There is some evidence to suggest that wounds of the apices of the lungs—that is, the portion that would collapse last—are associated with large collections of bloody fluid in the pleural cavity.

The bloody fluid present in the chest in cases of haemothorax consists in the main of defibrinated blood—that is, a mixture of serum and blood corpuscles, often presenting to the eye a considerable resemblance to blood, but differing from it in that it does not usually undergo massive clotting after removal from the chest. The parietal and visceral pleurae are covered to a greater or less extent with a layer of fibrin, and it is probable that the defibrination of the blood occurs as a result of the movements imparted to it by the respiratory and cardiac movements, and that it usually takes place very soon after the blood is poured out into the chest. Direct experiment has shown that the bloody fluid in haemothorax contains no fibrinogen, and hence, that although it resembles blood to the eye, clotting has really taken place, and that it is in reality defibrinated blood (Elliott and Henry).

Even in cases of sterile haemothorax the whole of the fluid in the chest is not defibrinated blood. This is shown by two facts: first, the cell content of the fluid is different from that of defibrinated blood in that an increased number of lymphocytes may be present together with endothelial cells, eosinophile cells sometimes in considerable numbers, and marrow cells; secondly, the quantity of fluid is sometimes very large, that is, four to five pints, and even then the patient may not show any gross or obvious signs of anaemia. Hence it is evident that there is some pleural exudate as a sequel to, and result of, the presence of the blood in the pleural cavity. In some cases further evidence of the presence of pleural exudate is afforded by the occurrence of a slight and peculiar clotting in the fluid removed from the chest by paracentesis. This clotting resembles that seen in the fluid of ordinary pleural effusions, but differs from it in that the coagulum contains abundant red corpuscles. This clot, although containing red corpuscles, is often scanty and generally gelatinous in consistence, and hence quite different in appearance from the clot formed from normal entire blood. The superficial resemblance of this "secondary clotting," as it is termed by Elliott and Henry, to true clotting is readily explained, inasmuch as the pleural exudate has added coagulable material to the defibrinated blood present in the pleural cavity and the abundant red corpuscles present have been entangled to a greater or less extent in the coagulation. In a small number of cases defibrination of the extravasated blood would seem not to occur, and paracentesis then reveals the presence of a mass of soft jelly-like clot that blocks the needle and prevents satisfactory aspiration; presumably in such cases more or less massive clotting has taken place.

In infected haemothorax the pleural exudate is much more abundant, and hence numerous polymorphonuclear leucocytes are found on microscopic examination, and the fluid removed by exploratory puncture may yield a deposit of pus visible to the naked eye. The fluid itself is often of a crimson colour from the haemolysis that has taken place. Massive clotting would also seem to be more common in infected cases, since, both at operations and in the *post-mortem* room, large clots may be found, especially in the lower part of the pleural cavity between the diaphragm and the chest wall, and also in the vertebral groove. In these infected cases the inflammatory exudate is apt to be poured out rapidly, and a sudden considerable increase in the amount of fluid in the chest is often strong clinical evidence of the presence of infection, since, as mentioned above, secondary haemorrhage into the pleural cavity in haemothorax is very rare, and then only occurs in infected cases. In sterile cases there is neither secondary haemorrhage nor a sudden copious effusion to cause any sudden great increase in the amount of fluid present in the pleural cavity. In a considerable proportion of these infected cases there is not only a rapid pouring out of inflammatory exudate, but, in addition, there is gas formation, owing to the infection being dependent upon the presence of anaërobic gas-producing organisms. The development of gas is often very rapid, and such cases may present very urgent signs and symptoms that increase rapidly in the course of a few hours. In others the clinical picture is much less urgent, and in a few only slight symptoms are present, and the condition is only appreciated after careful examination.

The gas may be free in the pleural cavity, associated with very considerable collapse of the lung, and a variable but usually large amount of haemothorax fluid. In other instances the conditions are more peculiar; the collection of gas is localized above the haemothorax fluid, and below the emphysematous over-distended upper lobe of the lung. The loose fibrinous adhesions at the upper level of the fluid in the thorax are probably sufficient to tether the upper lobe to the chest wall, but whether this be the correct explanation of the non-collapse of the entire lung or no, the fact remains that the gas forms a localized collection above the fluid of the haemothorax and below the non-collapsed portion of the lung. Such localized collections of gas are usually in the lateral or postero-lateral regions of the chest, and more especially in its lower portions. The gas is usually offensive, and has either a definite faecal smell or else that of rotten eggs. It is often present under considerable pressure, and in the *post-mortem* room, if a cannula is inserted, the gas issuing from it readily burns, when lighted, with a bluish flame. In cases of this type there is often considerable displacement of the heart, and this displacement may develop with great rapidity—that is, 2 in. in twenty-four hours. In cases where the gas is free in the pleural cavity, the clinical picture is that of pneumothorax or pyopneumothorax; and where the condition develops rapidly the symptoms are apt to be urgent and the error may be made of regarding the case as one of progressive pneumothorax, whereas in reality the phenomena are due to the rapid formation of gas under pressure as the result of infection of the haemothorax fluid.

In infected haemothorax the deposit on the surface of the collapsed lung is much more abundant and thicker than in sterile cases, as a thick layer of lymph more or less organized is often present. This is of considerable importance, inasmuch as this deposit hampers the subsequent re-expansion of the lung after the removal of the fluid by drainage of the pleura. The longer the delay in draining the pleura in such cases the greater is the organization of this deposit, and therefore there is much risk of permanent incomplete expansion of the lung. The deposit on the pleura not only causes the re-expansion of the lung to take place more slowly but also less perfectly, hence it is most important that cases of infected haemothorax should be treated and thoroughly drained at the earliest possible moment. Bilateral haemothorax is not very uncommon, and such collections are usually of small or moderate size; they may be either sterile or infected, and cases have occurred of bilateral infected haemothorax that have recovered after drainage of both pleural cavities. In bilateral haemothorax one side may be sterile and the other infected, and recovery has here taken place after aspiration of the sterile and drainage of the infected haemothorax. Bilateral haemothorax may be associated with haemopericardium, or in infected cases pericarditis may occur as a complication. The pericarditis seen in cases of infected haemothorax is probably usually of streptococcal origin, but in some instances an anaërobic infection of the pericardium may occur and then very striking physical signs may be present owing to the presence of gas and fluid in the pericardial sac. Two such cases have fallen under the observation of the writer and both recovered after opening and draining the pericardium. In one the condition was recognized as the result of the percussion of the pericardial area yielding a tympanitic note when previously a dull note due to the presence of effusion in the pericardium had been present. Pericarditis probably only occurs in infected cases, although pericardial friction and the signs of fluid in the pericardium may be detected in cases of sterile haemothorax, where, in addition to the pleural lesion, there is also the probability of injury to the pericardium and where *x*-ray examination may reveal the presence of a bullet in close proximity to the heart. The accurate diagnosis of such cases is often difficult, but it is probable, inasmuch as they often have no symptoms indicative of pericarditis, and they recover, that the pericardial physical signs are due to the presence of a haemopericardium rather than to a pericarditis with effusion. In the infected cases the presence of pericarditis is a very serious complication; in some there is merely greasy lymph, in others a moderate effusion, or where an anaërobic infection is present the pericardium may contain gas as well as an effusion. If the effusion is at all large in amount it is usually situated in the posterior part of the pericardium, and is therefore liable to produce some degree of pressure on and collapse of the lower lobe of the left lung. In very large effusions the transverse diameter of the pericardium is greatly increased. When the effusion is posterior in position, the heart may still remain in partial contact with the chest wall anteriorly, and thus, owing to the persistence of friction the presence of even a large effusion may be overlooked.

Complications.

The complications directly associated with haemothorax are few and are most frequently seen in cases of infected haemothorax. Purulent bronchitis, pneumonia, pleurisy, massive collapse of the lung, and pericarditis are the most common complications. Abscess and gangrene of the lung may occur, but these are dependent not on the haemothorax but on pulmonary lesions produced by the missile. One case of meningitis due to streptococcal infection in association with an infected haemothorax has fallen under my observation, but no case of cerebral abscess.

The relation of purulent bronchitis to haemothorax is often very doubtful, as it occurs so frequently apart from wounds, but many patients give a history that is suggestive of the onset of the bronchitis after the wound, although even in these it may be dependent on exposure. One of the most striking features of its distribution is its absence in that portion of the lung that is collapsed beneath the haemothorax effusion. Pneumonia, in various forms, may be present, but is not common, and here again the collapsed lung on the side of the haemothorax is not involved. It may occur on the side opposite to the haemothorax, but care must be taken in the diagnosis, as the physical signs of massive collapse present great resemblance to those of pneumonia, and, as will be mentioned later, contralateral collapse in cases of unilateral chest wounds is of quite frequent occurrence. There is, however, clear evidence from autopsy that pneumonia on the side opposite to the wound may occur in haemothorax. Septic bronchopneumonia is common in wounds of the chest wall not accompanied by haemothorax, where, as a result of the impact of the missile, the lung is bruised and haemorrhage into its substance has occurred. Pleurisy, often dry, is also not uncommon on the side opposite to the haemothorax; this occurs most often in infected haemothorax, but some instances have been seen where there was no bacteriological proof that the haemothorax was infected. Pleurisy of a serious type, and often progressing to empyema, occurs as a result of injuries to the chest wall of a tangential character and associated often with fracture of one or more ribs. Septic bronchopneumonia may coexist in such cases. The contralateral pleurisy is especially prevalent in cases of streptococcal infection of haemothorax, and may also progress to effusion and the formation of an empyema. Such cases are necessarily very serious, and if, as is not infrequent, pericarditis is also present they are of the utmost gravity.

Source of the Haemorrhage in Haemothorax.

There is some difference of opinion as to whether the injury to the chest wall, or that of the lung, is the more common cause of the haemorrhage into the pleural cavity, and it is not possible to dogmatize on this subject. Morbid anatomy does not yield any direct evidence of the bleeding having arisen from the chest wall, but it is obvious that it would be very difficult to exclude the possibility of the wound of an intercostal vessel. On the other hand, it is not unusual to find direct evidence of blood coagulation in the track produced by the missile in its passage through the lung, and the wall of the track is also infiltrated, to a varying depth, by extravasated blood. Henry and Elliott record in their series four cases of perforating wounds of the lower chest wall involving the pleural cavity below the area occupied by the lung and not wounding the lung, and where no haemothorax existed. Many instances of extensive injury to the chest wall opening the pleura have been seen where the lung itself was not involved, and where no haemothorax was present. The great rarity of secondary haemorrhage in cases of haemothorax is also in favour of the pulmonary origin of the bleeding, since the collapse of the lung associated with the haemothorax tends not only to check haemorrhage directly but also to prevent secondary haemorrhage owing to the rarity of septic inflammations in collapsed lung. It is probable, therefore, that in the great majority of cases of haemothorax the source of the bleeding is the injury to the lung, although cases may be seen occasionally where the haemorrhage is derived from a vessel in the chest wall, such as an intercostal or the internal mammary artery, or one of the big vessels at the root of the neck. Injuries of the great vessels of the neck sometimes coexist with haemothorax; aneurysm of the innominate artery has been seen in association with pneumo-haemothorax, but in such cases it is probable that the haemothorax is really independent of the arterial lesion and due to other pulmonary lesions, and the haemothorax or pneumo-haemothorax may be on the opposite side to that of the arterial lesion.

In rare instances the haemothorax fluid contains, in addition to blood, bile. The bile is derived from the wound track involving the liver, and in such cases the bile may reaccumulate in the pleural cavity after paracentesis has been performed and the haemothorax fluid drawn off. Repeated paracentesis may be required to draw off the reaccumulations of bilious fluid, and it is remarkable that jaundice does not necessarily develop in such cases, although the amount of bile present in the pleural cavity may be very large. This is further evidence that the pleural cavity in cases of haemothorax does not readily absorb fluid, and the lack of absorptive power is probably in part dependent upon the fibrinous coating on its surface, and in part, perhaps, on the lack of efficient respiratory movement on the injured side. In one case there was evidence of the presence of stomach contents in the haemothorax fluid.

Signs and Symptoms of Haemothorax.

Dyspnoea, although often at first urgent, diminishes rapidly, and even when the quantity of fluid in the chest is large—that is, over three pints—it is not usually a marked feature after the first three days. It is, however, greatly increased by exertion and movement, and hence many patients on arrival at a base hospital after a long journey often have considerable dyspnoea and distress for twenty-four hours. Moderate pyrexia is usually present, and it may rise to 103° F.; but the pulse is not much accelerated, and is usually under 100, and the patient does not have much distress unless cough is severe, frequent, and painful. The continued presence of high fever, pain, distress, rapid pulse, and furred tongue should always suggest the possibility of the haemothorax being infected, and a sample of the fluid should be removed with an exploring syringe without delay in order to determine this point by bacteriological methods. Jaundice is an important sign, as, if marked, it is a characteristic sign of infection, and more especially infection with anaërobic bacilli. In simple sterile haemothorax only a slight icteric tinge is present in the conjunctiva, but in anaërobic infections a deep yellow jaundice involving the skin generally develops, often with great rapidity. Such a jaundice is often misinterpreted as indicating a wound of the liver, especially when the wound is in the lower chest, but jaundice is quite exceptional in liver wounds, whereas it is a very characteristic sign of infected wounds, and especially of anaërobic infections. It may also, of course, be seen in the course of streptococcal infections.

The physical signs produced by haemothorax present considerable variety and often are very difficult to interpret. They are much more complex than those usually regarded as characteristic of simple pleural effusion.

One outstanding sign, easily demonstrated by percussion and confirmed by *x*-ray examination, is that the diaphragm on the affected side is much higher than normal. The high level of the diaphragm is most easily demonstrated in left-sided haemothorax, since then the tympanitic percussion note due to the stomach resonance is readily obtained high up in the axilla, and also in the antero-lateral region of the chest. In some instances this tympanitic stomach resonance may reach so high a level as to merge into the area of skodaic resonance in the infraclavicular region above the level of the fluid, and unless care is taken a mistaken diagnosis of pneumothorax may readily be made. *X*-ray examination often reveals that the diaphragm is not only high but also immobile. The skodaic resonance obtained in the upper chest above the level of the fluid is usually much more marked and much more extensive in its distribution than that present in ordinary pleural effusion, and not infrequently extends beyond the middle line, and this fact again is liable to lead to confusion of the condition with pneumothorax. The distribution of the skodaic resonance is confirmed by the observations on the morbid anatomy, as these show that the upper portions of the lung, especially anteriorly, are greatly over-distended and emphysematous, and that quite frequently the upper lobe is so over-distended as to extend well beyond the mid-sternal line.

The high level of the diaphragm, notwithstanding the presence of a large amount of fluid in the chest, and the very extensive and marked skodaic phenomena are two striking features of haemothorax and are in contrast to what obtains in simple pleural effusion. Over the area occupied by the fluid, blowing tubular, or even cavernous, breath sounds are frequently heard on auscultation. They are not only more marked than those occasionally heard over pleural effusions, but they are also heard over a much larger area, instead of being limited, as in pleural effusion, to a small area in the vicinity of the angle of the scapula.

Bronchophony and oegophony are also well marked and very definite; pectoriloquy is by no means rare. The physical signs thus often present a more or less clear resemblance to those usually regarded as characteristic of pneumonic consolidation, and it is not surprising that in a considerable number of cases where haemothorax is present, the erroneous diagnosis of so-called traumatic pneumonia is made. The signs described above are not present in all cases; in some the signs are similar to those found in cases of pleural effusion—that is, dullness, weakness, or absence of vocal fremitus, and weak or absence of breath sounds. Further, a case may present at an early period of its course the first set of signs with well-marked tubular breathing, and later on, with an increase in the amount of fluid, the second set with weak or absent breath sounds. This is more especially observed in infected cases where a rapid and considerable increase of the effusion may occur. In others where, as a result of the presence of anaërobes, gas is formed, a cracked-pot percussion note may be elicited often over a localized area where previously the percussion note had been dull. In these cases a bell sound may or may not be obtained, but the percussion note is quite characteristic.

Collapse of the Lung.

In ordinary pleural effusion the chest on the affected side is usually obviously enlarged, and the respiratory movements are diminished in amplitude; this is also true of some cases of haemothorax, more especially when the amount of fluid present is very large—that is, four to five pints. In a considerable number of cases, however, a very different condition is present, inasmuch as the chest is flattened and retracted on the side of the effusion, and the movements are so much diminished that the affected side is practically immobile. This retraction and immobility of the side may be present not only when the amount of fluid is small, but also in many cases where there is a moderate collection of fluid, approximately two pints in amount, but it does not occur in association with the largest collections. It is remarkable that in cases where retraction and flattening are quite marked, the apex beat may be displaced, as in ordinary pleural effusion, towards the opposite and unaffected side. This retraction of the injured side is a remarkable and common phenomenon in cases of haemothorax, and it seems to be a fact of the same order as the high level of the diaphragm already noted. Sometimes it is only seen in the first few days after the wound, and then, with an increase in the amount of the effusion in infected cases, it is replaced by bulging of the usual type. Well marked tubular or even cavernous breathing is heard on auscultation in those cases where marked retraction is present, together with bronchophony and pectoriloquy. The retraction of the injured side, the immobility of the chest and the high level of the diaphragm, would all seem to be due to extensive collapse of the lung or of the lower lobe of the lung, a collapse that is out of proportion to the amount of fluid present in the pleura, and is really very probably a collapse that is more or less independent of the presence of the fluid, and has some other mode of origin. It may well be that this collapse is a constant phenomenon in cases of gunshot injury of the chest, but that when a large haemothorax coexists its presence is naturally attributed to the mere effusion and its real nature is only obvious where it is clearly out of proportion to the effusion. Thus cases of massive collapse of the lung on the side of the injury have been observed by Bradford and Elliott where the amount of the effusion was so small as not to need aspiration, and where the signs cleared up and the lung re-expanded after a short interval. There are, however, other facts that may be adduced in support of the view that the collapse is more or less independent of the effusion. Thus it may occur on the opposite side of the chest to that injured, and not only is this the case, but it is probably of quite frequent occurrence, only the physical signs produced are erroneously attributed to the presence of contralateral pneumonia when contralateral collapse is really the condition present. The main distinguishing feature between the physical signs of pneumonia and those of massive collapse is the position of the heart's apex beat; in pneumonia there is no appreciable displacement, whereas in massive collapse the apex beat is displaced towards the collapsed lung. In an ordinary haemothorax affecting one side it may be impossible to determine clinically whether physical signs on the opposite side are due to pneumonia or collapse, since if the apex beat is found displaced, the displacement will necessarily be attributed to the presence of the fluid on the injured side. In such cases the diagnosis of contralateral collapse is largely an inference based on the absence of the clinical picture of pneumonia and on the rapidity with which the signs clear up, but in any given case there may be much doubt unless the diagnosis is confirmed by autopsy.

Contralateral collapse, however, has been observed in cases of wounds implicating the chest wall only, where physical examinations confirmed by x-ray observations showed that there was no lesion of the pleural cavity on the wounded side, the injury being a contour wound. Nevertheless, in such cases very extensive massive collapse has been present on the side opposite to that wounded and where there has been no retained missile or other foreign body. In some instances the massive collapse has involved the whole of the left lung and the displacement of the apex beat into the left axilla has been very marked. Such patients do not present the clinical picture of pneumonia, although the physical signs in the affected lung are very similar, and the patients' general condition of comparative well-being, together with the absence of high fever, rusty sputum, etc., shows at once that they are not suffering from pneumonia. Further, contralateral collapse has been observed both during operation on the chest and also on autopsy. In one instance an exploratory operation was performed on a case of contralateral collapse under the impression that the physical signs indicated the presence of an intrapulmonary abscess.

Although the mechanism producing collapse of the lung on the side of the injury and on the opposite side is obscure and cannot be discussed here fully, the presence of this collapse is probably the explanation of the curious and characteristic physical signs so often present in haemothorax, such as the high level of the diaphragm and the frequent presence of tubular breathing, bronchophony, and pectoriloquy over the area of the pleura where fluid is present. This collapse of the lung must be regarded, therefore, as one of the leading, if not the leading, phenomenon of gunshot injuries of the chest. There is some evidence to suggest that it occurs early, soon after the infliction of the wound, as when cases are seen within a few hours of being wounded few physical signs beyond immobility and deficient air entry on the side of the injury can be detected. Such cases seen again twenty-four hours later may then show the ordinary signs of a haemothorax, but in their earlier phase the signs are often quite insignificant in comparison with the urgency of symptoms, such as distress and dyspnoea.

Displacement of the heart's apex beat is a valuable sign in haemothorax; sometimes it is of a simple character and similar to that seen in pleural effusion—that is, displaced to a varying degree away from the side of the haemothorax. In others the displacement is mainly dependent upon the presence of contralateral collapse, and, as mentioned above, in some of these cases, there is no pleural lesion—that is, no fluid, air, or gas in the pleura on the side of the injury—such cases may be misinterpreted unless care be taken in the examination. The displacement present in any given case may undergo an increase or a diminution. An increase in displacement is usually due to the haemothorax being really infected, and an increase in the exudation or gas formation has taken place in the interval between the two clinical observations.

A decrease in the degree of cardiac displacement in recent cases of haemothorax and occurring during the first week after the date of wounding is also not infrequent, and is often more difficult of explanation. It is commonly attributed to absorption of some of the bloody exudate; this, however, is highly improbable, since absorption from the pleura in these cases is extraordinarily slow and certainly does not occur to any appreciable extent in the early days after the wound. The return of the heart may be due to an alteration in the distribution of the haemothorax fluid dependent on increasing collapse of the lung on the side of the lesion, or else it may be due to disappearance of contralateral collapse. The degree of displacement of the heart in any given case is therefore a very uncertain guide of the size of a haemothorax.

DIAGNOSIS.

The main problem in diagnosis is the determination whether a haemothorax is infected or not, and this often presents difficulties, since a haemothorax that at first runs an apparently sterile course may be infected later, owing to the spread of infection either from the wound track or from some localized infection round a retained foreign body. In some of these cases of delayed infection, and more especially in those with anaërobic infection, the symptoms may develop with much rapidity, and be of such a character as to suggest the occurrence of secondary haemorrhage, where no haemorrhage has taken place. Rapid pulse, pallor, sweating, and collapse are not uncommon symptoms of a rapidly spreading anaërobic infection. Microscopic and bacteriological examination of the fluid withdrawn from the chest will generally determine absolutely the presence or absence of infection, provided care be taken to repeat the exploration and too much stress is not laid on the negative result obtained at the first puncture. It is often necessary to explore the chest at different levels. Cases are seen occasionally where the symptoms, and especially the character and duration of the pyrexia, suggest that infection is present, yet no bacteriological confirmation is obtained even with repeated paracentesis. Such cases may get well with no special treatment after running a prolonged course of several weeks' duration. Their explanation is difficult, but it may be that the pyrexia in such cases is dependent upon the inflammatory process in the wound track, and more especially in that in the lung, and that the layer of fibrin coating the pleural surfaces prevents the infection reaching the pleural fluid. Care must always be taken in considering the diagnostic significance of pyrexia that it is not due to some associated complication, such as purulent bronchitis, contralateral pleurisy, pneumonia, or pericarditis, although all such complications are much more liable to occur in infected than in sterile haemothorax. The rarity of pulmonary inflammation in the compressed lung on the side of the haemothorax should always suggest, if symptoms are urgent, that infection of the fluid is present rather than pneumonia, although the physical signs may be such as to render diagnosis difficult. In all such cases there should be no delay in making an exploratory puncture, as it is essential for the successful treatment of infected haemothorax that the cases should be recognized as early as possible.

TREATMENT.

In sterile haemothorax, if the amount of the bloody effusion is small, there is no need for any special active treatment; such cases do well, although their progress may sometimes be slow. If the effusion is at all large in amount—that is, the dullness reaching above the angle of the scapula—the fluid should be removed by aspiration about the end of the first week after the wound. In a few cases earlier aspiration may be required to relieve distress arising mechanically from the amount of fluid present. Aspiration with oxygen replacement is better than simple aspiration, since by this method, with suitable local anaesthetics, the operation can be carried out without discomfort to the patient and without any of the symptoms that so commonly occur in ordinary aspiration, and not infrequently prevent by their urgency the completion of the procedure. Further, with oxygen replacement practically all the fluid present in the chest can be removed at one sitting; this is rarely feasible with ordinary aspiration, where the development of such symptoms as a sense of constriction, distress, cough, etc., occurs before all the fluid has been removed. These unpleasant symptoms develop as a consequence of a too sudden change in the intrapleural pressure resulting from the rapid removal of fluid, together with incomplete adjustment owing to incomplete expansion of the lung. Different patients vary considerably in the degree of their tolerance of pleural pressure changes, and these are necessarily much influenced by the degree and rapidity with which the lung re-expands. With an oxygen replacement apparatus a measured quantity of oxygen at any desired pressure can be introduced, and thus violent and sudden changes in the intrapleural pressure are avoided.

For practical purposes it is not necessary to measure accurately the intrapleural pressure; it is sufficient to regulate the introduction of oxygen by the presence or absence of symptoms. The aspiration of the fluid should be temporarily stopped when distress or a sense of constriction is first noticed by the patient; if the symptoms do not subside at once, a small quantity of oxygen from the oxygen replacement apparatus (Parry Morgan or other) should be allowed to flow into the pleural cavity. Then with the relief of all distress, a further quantity of the fluid can be aspirated and the process continued until the operation is completed. The patient is left at the end of the aspiration with a small quantity of oxygen in the pleura—for example, 200 to 500 c.cm. at a pressure considerably less than the pressure of the haemothorax, but still appreciably above the normal pleural pressure. The oxygen is gradually absorbed in the course of the following week, but it is remarkable that many days are required for the pleura to absorb even small quantities of gas, and this slow absorption is probably due to the coating of the parietal and visceral pleura with fibrin, as it is in remarkable contrast to the rapid absorption of air that is known to occur after opening the normal pleura.

Free drainage is required in all cases of infected haemothorax, and it is of the utmost importance that this should be provided as early as possible, as the organization of the deposit of lymph on the visceral pleura produces a great impediment to the rapid expansion of the lung after the removal of the fluid, and this organization proceeds rapidly in cases where delay in operating takes place. Removal of the infected fluid by free drainage is, however, not sufficient treatment in all cases; the inflammation in the pleural sac and the septic clots must be treated by the local application of some efficient antiseptic, applied either by periodical washing out of the cavity or else by the instillation method and the Carrel-Dakin technique that is now so much used. If the cavity is treated by washing out, care must be taken to avoid raising the intrapleural pressure. Septic clots, often of considerable size, can be removed with success by this method. Recently the Carrel-Dakin technique has been applied with success to cases of infected haemothorax, and a few cases have already been so successfully treated that the operation wound required for the excision of the rib has been closed by secondary suture before the evacuation of the patient to England.

Two difficulties are met with in practice in cases of haemothorax. In one group of cases, although the pyrexia and the patient's general condition suggests the presence of infection, bacteriological examination does not confirm this. In another series of cases organisms are detected in the fluid, but there is little or no pyrexia, and the patient does not seem to be very ill. It is probable that some of the cases falling into this second group recover after simple aspiration, but their convalescence is often very slow, and certainly in some instances such cases develop serious and even urgent symptoms. For these reasons it is advisable to excise a portion of rib and procure free drainage in all cases of haemothorax where the bacteriological examination reveals the presence of pathogenic organisms, even if the clinical condition of the patient is not such as to suggest infection. As regards the first group, the position is more difficult, but it is probably wiser to delay opening the pleura until proof of infection in the fluid is obtained, as the pyrexia and even the other symptoms may have some other origin; it is a serious matter to open a sterile haemothorax in view of the possibility of secondary infection.

Care must be taken in selecting the site for excision of a portion of rib to provide really efficient drainage, and the fact that the diaphragm is abnormally high in these cases must be borne in mind, as otherwise the opening will be made too low down.

In some instances the wound of entry or exit communicates more or less directly with the pleural cavity and fluid in variable quantity drains from it; this drainage is rarely satisfactory or sufficient, and such cases require a counter opening in a suitable situation to really drain the effusion.

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CHAPTER XI.

TROPICAL MEDICINE AND HYGIENE.

BY

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It has long been recognized that a number of diseases are peculiar to, if not confined to, warm climates. Many hypotheses in explanation of this circumstance have been advanced, but it is only of late years—only since we have been able to recognize the germ causes of many of these diseases, or the media by or in which they are conveyed—that it has become possible to arrive at the true explanation. Almost without exception, tropical diseases—that is to say, those diseases which require for their successful propagation a warm climate—are caused either by a protozoal organism or by a helminth, which, in their turn, in order to pass from one vertebrate host to another, demand either an animal vector peculiar to warm climates, or require a warm medium in which to qualify for such passage. Hence, although tropical disease once acquired can run its usual course even if the person remove to a cold or even frigid climate, that person cannot spread the disease there, nor, under natural conditions, can the disease be acquired there. On the other hand, bacterial diseases may be acquired and spread in any climate, as the germs in their passage from one human host to another do not necessarily demand any special animal intermediary, nor are they destroyed in their passage by ordinary temperatures. In the following summary relating to British contributions to tropical medicine bacterial diseases are therefore not considered. It is true such bacterial diseases as leprosy, cholera, and plague are often referred to as tropical diseases, but a little consideration—a little investigation into their history and geographical range—will show that they have no more claim to be considered tropical diseases than have tuberculosis or syphilis.

Malaria.

Although a number of contributions of considerable importance in tropical pathology had been made by British as well as by other investigators prior to 1880 there can be no question that it was the discovery by Laveran of the malarial parasite, in the November of that year, that has led to the recent rapid and remarkable development in tropical medicine. It was some time before the value of Laveran's discovery was recognized, or the nature of the organism concerned and the significance of its various phases determined. Golgi made an important advance in these respects by working out the morphological features of the tertian and quartan parasites, and of what is now known as the schizogony or asexual phase. Further advances in our knowledge of this part of the life-cycle of the malarial parasites were also made by other Italian observers; but here, for the time being, progress ceased. It may therefore be said that, except as providing an invaluable guide in diagnosis and treatment, Laveran's discovery for more than a decade remained barren. It gave no clue to prevention; it did not tell us in what way malarial infection was acquired, nor did it explain its peculiar geographical and topical distribution and limitation.

As the development towards sexual maturity—a biological necessity for the malaria parasite as for all animal parasites—had never been traced in the human body, it follows that to effect this necessary development escape from the human body is essential. Neither Laveran nor Golgi's observations had filled in this important gap in the life-history of the parasite.

Golgi, it is true, had made out the significance of certain phases of the parasite as seen in the circulation; he showed in what way the invading organism multiplied after it had obtained entrance into the human body, but neither he, nor any of his co-workers, had grasped the significance of certain additional phases also represented in the blood, and more especially manifested on the microscope slip—that is to say, in blood after its removal from the human body.

Perhaps the most striking feature in connexion with the malarial parasite as observed under the microscope is the so-called "flagellated body." This squirming, wriggling, many-armed organism had long been a puzzle to the naturalist as well as to the pathologist. Some got over the difficulties of its explanation by pronouncing it to be a moribund or effete form of the parasite in its death agony. It had been observed that this flagellated body shows itself only in blood that had been for some time on the microscope slip—that is to say, after the parasite had been removed from the human body. It had never been seen in quite newly-drawn blood. Its development had been witnessed over and over again from certain intracorpuscular forms of the parasite, but only after the blood containing these forms had been in the field of the microscope for a considerable period. This fact of the flagellated body coming into existence as such only when the parasite from which it was evolved had left the human body suggested to the writer that its function lay outside the human body, and, if so, that it was the early extracorporeal phase of the parasite and, if we may use the expression, designed for its passage from one human host to another. But, assuming that such was the case, it remained to explain how an organism, which while still in the body was invariably included in a red blood cell, could spontaneously and by its own efforts escape from the human body. Such a feat on the part of a passive organism was inexplicable. I was driven to the conclusion that if this phase of the malarial parasite were really the first stage in its development outside the human body some extraneous agency must act as liberator. The question then came to be what this extraneous agency might be.

Many years before the writer had shown that in the case of another blood parasite—*Filaria bancrofti* (the *Filaria sanguinis hominis* of Lewis)—the mosquito acted as a liberating and also as a fostering agent. Impressed by the close parallelism, as regards their respective physical conditions and necessities, between the malaria parasite and the filaria—the one being imprisoned in a blood corpuscle and powerless to escape, the other, the sheath-included and equally helpless filaria—as well as their respective biological necessities, he thought that the same, or a similar liberating agency might be operative in both instances. An additional circumstance pointing to such a hypothesis was that both parasites are limited in geographical range to warm climates. On these considerations it was concluded that as the mosquito had been proved to be the liberating agent in the case of the filaria, it might be, and probably was, the liberating agent in the case of the malarial parasite, and therefore that the first phase of the malarial parasite outside the human body had to be passed in this insect. I formulated this hypothesis in the British Medical Journal of December 8th, 1894. Unfortunately, circumstances made it impossible for me to follow up the fate of the flagellated body in the mosquito, but Sir Ronald Ross, who was then in England, was so impressed with the probability of my hypothesis being correct, that on his return to India in 1895 he set to work to endeavour to establish it. After many years of intense application and in the face of many difficulties, he succeeded in tracing the malarial parasite into the stomach wall of certain "dapple-winged" (Anopheles) mosquitos. In consequence of difficulties in procuring material and suitable human subjects for observation and experiment, he transferred his attention to a malaria-like parasite (proteosoma) of birds. In these he succeeded in tracing the development of the parasite in the stomach wall of Culex mosquitos, and thence into the salivary glands and saliva of the insects, and by experiment showed that such insects were capable of conveying the infection to hitherto immune birds. Ross's observations were quickly confirmed by Daniels, Christophers and Stephens, Grassi, and many others. Grassi recognized Ross's "dapple-winged" mosquito as belonging to the anophelines, and showed conclusively that certain members of this family of mosquitos were efficient transmitters of malaria. Ross had not ascertained what exactly happened to the malarial parasite immediately after ingestion by the mosquito, and while still in the lumen of the insect's stomach, which enabled it to pass into the tissues of the stomach wall. An American observer—Macallum—filled in this gap. He showed that the flagellated body of halteridium, another malaria-like parasite of birds, was the male parasite, that the flagella it produced functioned as spermatozoa, that when they broke away in the blood in the stomach of the mosquito they entered a female parasite, inducing therein a development that eventuated, while the female was still in the stomach of the insect, in the formation of that "travelling vermicule," which penetrated the stomach wall and therein entered on the development Ross had so successfully traced. Thus was completed the history of the life-cycle of the malarial parasite outside the human body, confirming the mosquito-malaria hypothesis.

Although the work of Laveran and Ross was accepted by those best competent to judge, and although the direction in which its principal application should be made was evident to all well-informed tropical sanitarians, the public was by no means convinced of its reliability or of the importance of the mosquito as a diffusing agent of malaria. Experiments on human beings had succeeded in the hands of the Italians in demonstrating that a mosquito fed upon a malarial patient could, after an interval of ten to twelve days, convey malaria to hitherto immune individuals, but the public did not appreciate this, and moreover, as the experiments had been conducted in malarious countries there was always a possibility that some unsuspected fallacy associated with locality had crept in, seeing that other influences which might include the true malaria influence were possibly operative. Accordingly, the British Colonial Office, believing in and recognizing the importance of the discoveries as bearing on the health and prosperity of tropical countries, devised an experiment designed to convert the public to the mosquito-malaria theory and to facilitate in this way practical measures based on that theory. In 1900 it sent to the Roman Campagna an expedition consisting of Drs. Sambon and Low, of the London School of Tropical Medicine (who were subsequently joined by an artist), with instructions to live in a mosquito-protected hut located in a highly malarious district of that highly malarious region during the most malarious season of the year, protected at night only, and by wire gauze covering only, from mosquito attack. Although the people about them were heavily affected with malaria these observers, relying solely on mosquito protection, remained in perfect health. At the same time mosquitos infected in Rome with malarial parasites were sent to London by the same observers, and were there fed on two Englishmen who had never been exposed to malarial influences, or been in malarious countries, with the result that both these men contracted malarial fever and showed malarial parasites in abundance in their blood. This crucial experiment was accepted by the most sceptical as conclusive proof of the mosquito-malaria theory.

It was long before Laveran's discovery was appreciated in England, but it made way by degrees, and its significance and importance became thoroughly apprehended by a few. It may be said that it led more or less directly to the establishment, at the instance of the late Mr. Joseph Chamberlain, of our schools of tropical medicine, wherein large numbers of post-graduate students destined for service in tropical countries were taught haematology and the study of the blood parasites generally. These students, well taught in blood examination with high powers of the microscope, were, as a result of this training, not only more efficient practitioners but before long were instrumental in discovering other pathogenic organisms of importance in tropical pathology. Some of these discoveries may be referred to.

TRYPANOSOMIASIS.

Forde, a former student of the London School of Tropical Medicine, found in the blood of an Englishman living in the Gambia and suffering from an irregular fever an organism the nature of which he failed to recognize. He showed it to Dutton, an emissary of the Liverpool School of Tropical Medicine, who recognized it to be a trypanosome, and named it *Trypanosoma gambiense*. Sir David Bruce, Nabarro, and many others definitely linked up the trypanosome of Forde and Dutton with sleeping sickness as cause and effect. The parasite having been discovered and its association with sleeping sickness confirmed, it became a matter of importance to ascertain in what way the infection was conveyed. Just as happened in the case of the malarial parasite, some antecedent observations led to the clearing up of this point. Many years before Forde and Dutton's discovery Lewis described a similar organism (*Trypanosoma lewisi*) as a frequent parasite in the blood of the rat. Apparently this parasite of the rat was non-pathogenic. Not long afterwards Evans found a similar parasite in the blood of equines, bovines, and other domestic animals, in association with, and as the undoubted cause of, the deadly disease known in India as "surra."

In 1894 Sir David Bruce investigated in Zululand the disease known in South Africa as "fly disease," an epizootic extensively prevalent among and fatal to domestic animals in South Africa and other parts of that continent, and therefore of great economic importance. He very soon found a trypanosome (*Trypanosoma brucei*) in the blood of the stricken animals and also in the wild game of the infected districts, and confirmed the popular belief that the disease was conveyed by the bite of the tsetse fly—*Glossina morsitans*—one of several species belonging to a genus of biting flies peculiar to Africa.

In the light of this antecedent knowledge it was not long before Bruce and his colleagues in Uganda were able definitely to link up sleeping sickness and its parasite with another species of tsetse fly, *Glossina palpalis*, very prevalent in the afflicted sleeping sickness areas. Observations on the topical distribution of the fly and of sleeping sickness confirmed the conclusions arrived at by experiment on the lower animals—some of which were found to be susceptible to the infection, and to be harbourers of the parasite even under natural conditions.

Bruce at first supposed that the fly transferred the trypanosome directly and in a mechanical way on its blood-fouled proboscis from the infected to the uninfected, just as the lancet inoculates the vaccine virus; but a German (Kleine) showed that although such might be the case in a small proportion of instances, and for a short time—twenty-four hours—after the fly had bitten, in the majority of cases the parasite was conveyed only after it had undergone developmental changes in the fly—changes which require some eighteen days to complete, and which eventuate in a proportion of flies becoming permanently infective. Miss Muriel Robertson, who had previously made important contributions in the morphology and life-history of the trypanosomes of some of the lower animals, confirmed Kleine's observations, and also considerably expanded them by showing that it was only during a particular period in the recurring cyclical multiplication of the trypanosome in the circulation of the vertebrate host that it could be efficiently conveyed to its intermediary the tsetse fly. Further, this talented protozoologist traced the development of the parasite in this insect through its various phases in its passage from the alimentary canal to the salivary glands and thence to the vertebrate. Concurrently with investigations into the life-history of the trypanosome others were directed to ascertaining the topical distribution and bionomics of *Glossina palpalis*, notably by Hodges and Bagshawe.

For some time it was believed that man was subject to only one of the considerable number of trypanosomes now known to affect the vertebrates, but recent discoveries have shown that he is subject to invasion by at least two other members of the group equally, if not more, dangerous—namely, *Trypanosoma cruzi*, an American species which so far has not been studied specially by British observers, and *Trypanosoma rhodesiense*. The discovery of this latter trypanosome we owe to Stephens and Fantham. It appears to be confined to Rhodesia, particularly, but not entirely, to the north of the Zambesi. Morphologically it resembles *Trypanosoma brucei*, if it be not identical with that trypanosome, and like *Trypanosoma brucei* is transmitted, as shown by Kinghorn and Yorke and others, by *Glossina morsitans*.

Much attention has been given by British workers to the symptomatology and morbid anatomy of sleeping sickness. As regards the latter, the most important observations are those of Mott, who has shown that the nervous symptoms of the disease are the result of an extensive small-cell infiltration of the perivascular connective tissue of the brain, very similar to that occurring in general paralysis of the insane.

Tick Fever.

Vandyke Carter was the first to describe a spirochaete in association with the relapsing fever of India, a spirochaete possibly identical with the *Spirochaeta recurrentis* of Obermeyer. According to Mackie, it is transmitted in India by the louse. Livingstone and Sir John Kirk had called attention many years ago to a fever prevalent in particular parts of Portuguese East Africa (notably Tete on the Zambesi) which was attributed locally to the bite of the carrapata, a tick having bug-like habits. It was reserved for Milne and Ross in Uganda and Dutton and Todd on the Congo to show that this African carrapata disease is a relapsing fever, and that it is caused by a spirochaete—*Spirochaeta duttoni*—which, in its turn, is transmitted from man to man by the bite of the tick *Ornithodorus moubata;* and, further, that it can be transmitted not only by the tick originally infected but also by the progeny of that particular tick. At first there was some doubt as to whether or not the new spirochaete was identical with that of Obermeyer, but well marked differences in their respective pathological and clinical effects on man, as well as the experimental work of Kinghorn and Breinl, showed that, although morphologically similar, they were specifically distinct. The life-history of the spirochaete in the vertebrate host has been worked out to some extent, particularly by Breinl, of the Liverpool School of Tropical Medicine, and in the tick by Sir William Leishman, R.A.M.C. According to Breinl, the parasites, when they disappear from the blood at the crisis of the characteristic recurring febrile paroxysms, are taken up and destroyed for the most part by the phagocytes; a proportion, however, enter certain cells wherein they coil up and, ultimately, after breaking up into a number of granules, escape as such from the cell and develop in the blood into the spirochaetes which, on maturing, give rise to the succeeding paroxysm of fever. As regards the spirochaetes in the tick, Leishman found that on entering the stomach they also break up into minute granules, which pass into the cells of the Malpighian tubes, and thence into the eggs of the tick, and also into its excreta. Thus the parasite has double opportunity of survival, either in the next generation of ticks or by passing out in the excreta of the tick and so obtaining access to a human or other vertebrate host through contamination of the wound it inflicts when the tick next proceeds to feed. Balfour has made some very interesting observations on the process of granule formation and discharge in the case of a similar spirochaete in Sudanese fowls, which tend to throw light on what occurs in *Spirochaeta duttoni*, both in the tick and in the human body.

Yaws.

Soon after the discovery of the spirochaete of syphilis by Schaudinn, Castellani, then of the Ceylon Medical Service, described a similar though different organism, *Spirochaeta pertenuis* (v. *pallidula*) as the germ cause of yaws. His observations have been confirmed and are now generally accepted. The same observer described another species of spirochaete, *Spirochaeta bronchialis*, as the cause of a form of chronic bronchitis occurring in Ceylon, and probably in Africa.

Leishmaniasis.

Medical men in India and elsewhere have long been familiar with a form of chronic irregular fever associated with great enlargement of the spleen and liver. It is a deadly disease. In parts of India—Assam, for example—where it is especially prevalent and is called kala-azar, it is a serious matter, having swept away a large part of the population of some districts, and is, or was, spreading steadily as an epidemic over a large part of the Brahmaputra valley. The disease was generally relegated to the malarial group, although some observers, being struck with the absence in this febrile splenomegaly of the three pathognomonic marks of malaria—namely, tertian or quartan periodicity, amenability to treatment with quinine, and the presence of the malarial parasite or its product, haemozoin, in the blood—refused to acknowledge its malarial nature. Several commissions sent by the Government in India to ascertain the exact nature of the disease completely failed to establish its etiology. Some of us thought that kala-azar might possibly be due to some parasite similar to the trypanosome, at that time recently discovered in association with a chronic irregular fever and sleeping sickness. Sir William Leishman in 1902, and again in 1903, almost simultaneously with Donovan, found in the spleen, in cases of Indian febrile splenomegaly, a minute oval body possessing two nuclear masses, one spherical or oval and relatively of considerable size, the other linear or bacilliform and very minute. Extended investigations have shown that these oval bodies are present in the spleen, liver, bone marrow, and elsewhere in every case of kala-azar, and that they are characteristic and the cause of this deadly disease, which, as we now know, is by no means confined to India. Attempts at cultivation on bacteriological lines, that is to say in warm media, were unsuccessful. Later, however (in 1904), Sir Leonard Rogers ascertained that if these Leishman-Donovan bodies, as they came to be called, were kept at ordinary tropical atmospheric temperatures, about 22° Centigrade, in a sodium citrate solution, they underwent a remarkable development, first multiplying by division and later on developing into flagellated herpetomonas forms. This discovery indicated that the parasite is capable of living outside the human body, it may be in some cold-blooded animal, such as an insect or other intermediary. From the point of view of prevention, it is extremely important that the life-history of *Leishmania donovani* be completed. In endeavouring to attain this desirable end workers must not allow themselves to be too much obsessed by the fact that in the similar parasites of malaria, of trypanosomiasis, of spirochaetosis, as well as those of yellow fever and of dengue, an arthropod intermediary is essential in their life-history. Possibly *Leishmania* requires such a vector and intermediary; analogy certainly suggests this, but suggestion is not proof. The recent, and to my mind very important, observations of Laveran and Fantham and Porter have shown that similar flagellated organisms—proper to insects, etc.—can be transmitted both by inoculation and by the mouth to warm-blooded vertebrates and flourish in them, such transmission being by no means in every instance a biological necessity for these parasites. It is true that Patton has succeeded in tracing the development of *Leishmania donovani* up to a point in the bed-bug, but so far his observations have not been accepted as conclusive that the bug is the transmitter or a necessary agent in the life-history of Leishmania.

Not long after the discovery of the Leishman-Donovan body in kala-azar similar parasites were found by Wright in Oriental sore, of which troublesome form of ulceration they are undoubtedly the germ cause. Still more recently similar bodies have been found in a variety of other ulcerative affections in tropical America and, by Christopherson, in the Sudan, one of them, Espundia, being a very grave disease indeed.

Yellow Fever and Dengue.

There are two fevers peculiar to warm climates which, though differing very much as regards gravity, have in some respects, both etiologically and clinically, many features in common. I refer to yellow fever and dengue. (1) Their respective germs exist in the blood and are ultramicroscopic; (2) their germs are conveyed to man by the same species of mosquito, *Stegomyia calopus;* (3) one attack confers absolute or relative immunity; (4) in both there is a primary fever and generally a secondary fever; (5) in both there is marked flushing of the skin, violent headache, general aching, and a rapidly attained high temperature which is generally associated with a relatively slow pulse; the duration of the primary fever—three, four, or five days—is about the same in both. These etiological and clinical features held in common suggest some kind of relationship as regards the respective germs. Carlos Finlay of Havana was the first to endeavour to prove experimentally that yellow fever was conveyed by mosquito bite, and he distinctly indicated *Stegomyia calopus* as the species concerned. His experiments were neither numerous nor convincing, and the subject was dropped till the American commissioners—Reed, Carroll, Agramonte, and Lazear—took the matter up and definitely established the fact that yellow fever is transmitted by the bite of *Stegomyia calopus* and, in nature, by no other means. The practical application of this discovery, in Havana and on the Panama Canal by Gorgas and his colleagues, and by others elsewhere in tropical America, has led to what must be regarded as one of the greatest triumphs of preventive medicine, whether in the tropics or elsewhere. Any claim for a share in this important achievement that might be advanced for British workers can be at most only an indirect one.

Fortunately the deadly yellow fever has hitherto been confined to tropical America and West Africa, extending to Western Europe and parts of America only at long intervals and only during the hot months of the year, and even then only in circumscribed epidemics. Not so dengue; it occurs in extensive epidemics throughout the entire tropical and subtropical belts, where in certain places it is more or less endemic. Why yellow fever has not a similar distribution is hard to explain, seeing that both diseases are conveyed by the same Stegomyia mosquito. It is only quite recently (1916) that Stegomyia has been proved to be a vector of dengue. For this important piece of information we are indebted to three Australian physicians—Burton Cleland, Bradley, and McDonald. It is true that previous workers had blamed the mosquito as the vector of the germ of dengue—notably Graham in Syria in 1903, and, later, Ashburn and Craig in Manila, but in neither case were the experiments satisfactory, and it would appear now that the mosquito which they blamed—namely, *Culex fatigans*—is not the only transmitter, if it be a transmitter at all. The Australian physicians referred to, although they failed with *Culex fatigans*, succeeded in communicating dengue, under conditions which completely excluded every possible source of fallacy, by infected *Stegomyia calopus*.

Pappataci Fever.

Pappataci fever—an ephemeral fever of approximately three days' duration and regarded sometimes in tropical countries as a fever of acclimatization—has long been known to tropical practitioners. Shortly before the part played as vector by *Phlebotomus papatasii* was known the clinical characters and specific nature of this fever were described and recognized by James in India and McCarrison in Chitral. Subsequently Birt confirmed the discoveries of Doerr, Franz, and Taussig as regards the part played by *Phlebotomus*, and British naturalists have worked out in a great measure the bionomics of that insect.

Undifferentiated Fevers of the Tropics.

There can be little doubt that in addition to the foregoing there are other fevers of a specific nature peculiar to the tropics, whose germ causes and vectors have hitherto escaped detection. Many attempts have been made by British observers, particularly Crombie and Leonard Rogers, to classify these fevers on a clinical basis, but until the germs or their vectors have been recognized, any arrangement of this nature can be regarded only as a temporary one.

Helminthiases.

Trematodes.

Of late years many additions have been made to the list of trematodes invading tropical mankind, as well as to our knowledge of the pathological effects and life-histories of the more important of them. For much of this we are indebted to British investigators.

I may cite the new West African fluke, *Watsonius watsoni*, discovered by Dr. Watson in 1904, and since found to be not uncommon in certain parts of Nigeria; *Gastrodiscus hominis*, discovered by Lewis and McConnell in India in 1876; *Echinostoma malayanum*, by Drs. Macaulay and Stanton in 1911 in the Malay States; *Clonorchis sinensis*, by McConnell, in 1874; *Opisthorchis noverca*, by Lewis and Cunningham, in 1872; *Fasciolopsis buskii*, by Busk, in 1843; *Paragonimus westermanii*, for the first time in man, by Ringer in Formosa in 1880, its ova having been recognized previously and independently by Baelz and the writer as a characteristic feature in the sputum of patients suffering from a somewhat serious form of endemic haemoptysis occurring in Japan, Korea, Formosa, and the Philippines.

Schistosomiasis.

These discoveries, though interesting to the helminthologist, are of comparatively small importance to the pathologist, especially if compared with the most recent discoveries in connexion with that peculiar family of trematodes, the Schistosomidae, including *Schistosoma haematobium* (Bilharzia), *Schistosoma mansoni*, and *Schistosoma japonicum*.

Since Bilharz, in Egypt, in 1851, discovered the parasite which bears his name it has been ascertained that this trematode is widely distributed throughout the African continent, the adjacent islands, and in parts of Asia; that in many districts it is very prevalent—for example, Lower Egypt, where it affects one-third and in some places even 90 per cent. of the fellaheen population; that it is the cause of grave and even fatal disease; and that it has a decidedly deteriorating influence on the general health and therefore on the economic condition of the seriously affected area. Its pathological effect has been fairly exhaustively studied of late years, especially by Madden, Milton, Sandwith, and others, and the morphology of the adult worm and its ova determined, but the important matter of its life-history and the channels by which it enters the human body were until quite recently (1916) either quite unknown or at most mere matters of speculation. Dr. Leiper of the London School of Tropical Medicine, by a series of brilliant observations and successful experiments, has now completely filled in this hiatus in our knowledge, and has thereby placed in the hands of the sanitarians a sure guide in developing methods for the prevention of a disease which hitherto has proved the despair of the therapeutist. The history of Leiper's discoveries is interesting, not only as regards the subject they concern more particularly, but also as once more showing how what at the time appears to be a discovery with relatively small bearings may, sooner or later, lead to others of vastly greater importance.

A chronic and very fatal disease characterized by enlargement of the liver and spleen, blood and slime in the stools, anaemia, and ultimately ascites, had been recognized for a considerable time as endemic in certain parts of Japan and China. Subsequently the ova of a trematode were found to be a feature in the stools and organs of such cases. Still more recently Katsurada found in the liver of cats from one of the endemic areas numerous schistosomes containing eggs identical to all appearances with those found in the faeces of the human subjects of this disease; and still later, 1905, Catto found the same parasite and eggs in the organs of a Chinaman who died in Singapore. The disease is now known as Katayama's disease. Japanese observers have found that its parasite, *Schistosoma japonicum*, can be communicated to cats simply by immersing them in the water of certain rice fields in the endemic area. It was not essential that the water should be swallowed; simple immersion of part of the body of the cat sufficed. Myari succeeded in infecting animals from a mollusc common in these rice fields. He traced the development of the trematode in the mollusc and concluded that man acquired infection by working in the rice field, a conclusion supported by the experience of Europeans in China, principally sportsmen devoted to snipe shooting, who, it is to be presumed, had acquired the disease in wading through rice fields or swamps. Leiper, impressed by these observations and recognizing their possible bearing on bilharzia disease of Egypt, applied for and obtained permission and facilities from the London School of Tropical Medicine to proceed to the Far East to familiarize himself with and to test Myari's conclusions. The latter, somewhat modified, he confirmed. Returning to England, he placed the matter before the War Office authorities, who, recognizing the importance of bilharzia disease to the large body of troops assembled in Egypt, and acting in concert with the Medical Research Committee, commissioned Leiper to proceed at once to that country to study locally the etiology of bilharziasis and to suggest measures for its prevention and for the protection of the troops. In a very short time Leiper, assisted by Drs. J. G. Thomson and Cockin, ascertained that on emerging from the terminal-spined egg, opportunity serving, the miracidium of *Schistosoma haematobium* enters the liver of a fresh-water mollusc, a species of *Bullinus* (*dybowski*), very common in the irrigation canals of Egypt, and transforms into a sporocyst and daughter sporocysts, wherein vast numbers of cercariae develop. The cercariae ultimately escape into the water, penetrate—opportunity offering—the skin of man or other vertebrate, and, dropping their tails in the passage, find their way into the liver of the vertebrate host, wherein, after six to ten weeks, they attain sexual maturity, becoming adult trematodes, which, passing into the veins of the bladder, produce the characteristic terminal-spined eggs which escape in the urine.

During these investigations Leiper was able to settle another and much disputed point in connexion with bilharziasis. It had long been recognized that there are two types of bilharzia ova, one terminal-spined and passed principally in the urine and only occasionally in the faeces; the other lateral-spined and, practically, found exclusively in the faeces. Both types of ovum were generally attributed to the same species of trematode, the difference in the position of the spine being variously explained. In 1903 the writer, in examining the faeces of an Englishman from the West Indies, encountered numerous lateral-spined ova. Seeing that the patient had never visited Africa or any other region where bilharziasis was known to be endemic, that the urine contained no terminal-spined ova, and that, although thousands of examinations of the urine must have been made in the West Indies, bilharzia ova had never been reported from that part of the world, he suggested that the schistosoma producing these lateral-spined ova must belong to a species other than that producing terminal-spined ova. Sambon, adding many additional reasons, concurred in this view and paid me the compliment of naming the new species *Schistosoma mansoni*. Looss, who considered that this trematode did not require an intermediary, refused to accept the species. Leiper, however, in the course of the investigations just referred to, found that the miracidium of the lateral-spined ova enters a species of snail, *Planorbis boissyi*, quite distinct from the Bullinus favoured by the terminal-spined ova, and that on reaching the vertebrate host developed into a sexually mature schistosoma anatomically quite distinct from that resulting from infection from the miracidium of the terminal-spined ovum. Thus *Schistosoma haematobium* produces only the terminal-spined ova, and *Schistosoma mansoni* only lateral spined ova, and are distinct species. Quite recently many cases of lateral-spined bilharziasis have been reported from the West Indies and Brazil, but never a case of terminal-spined bilharziasis, so that now there can be no question as to the validity of the new species *Schistosoma mansoni*. In further confirmation of this conclusion Lutz has found that a Planorbis is its intermediary host also in Brazil.

Dracontiasis.

Although the anatomical features of the adult guinea-worm and of its larva had been ascertained, little was known of the life-history of this formidable parasite until Fedschenko discovered in 1870—a discovery subsequently confirmed by the writer—that the larva on being passed into water enters the body of a fresh-water cyclops, wherein it undergoes extensive developmental changes. In 1907 Leiper was sent by the London School of Tropical Medicine to West Africa to endeavour to ascertain in what way the parasite after leaving cyclops returns to man. He found that if the infected crustacean were immersed in a weak (0.22 per cent.) solution of hydrochloric acid (in imitation of gastric juice) the cyclops was immediately killed, whilst the included parasites, on the contrary, were stimulated to great activity, and bored their way through the integument of the cyclops. This experiment, he conjectured, indicated the route likely to be followed by the guinea-worm in nature. As confirmatory experiment on man was out of the question, Leiper administered infected cyclops to a monkey, and had the satisfaction, on the death of the monkey several months later in England, of finding three female and two male guinea-worms in an advanced state of development in its tissues. From this we may conclude that the infection is acquired by man from cyclops-infested drinking water fouled by guinea-worm carriers. Efficient preventive measures are clearly indicated by this new knowledge.

Ascaris lumbricoides.

It has been generally accepted that the experiments of Davaine, Grassi, and other Continental workers had proved that the larvae in the ripe eggs of ascaris were hatched out in the human intestinal canal, and therein immediately proceeded to sexual maturity. Quite recently, however, the experimental work of Stewart tends to show that the life-history of this very common parasite may be not quite so simple. Sambon already had pointed out that the papilla or beak, a conspicuous feature in the larval ascaris, indicated that the little organism at an early stage of its existence bores its way into the tissues. Stewart has now shown that if ripe ascaris eggs are fed to a mouse many of the larvae liberated in the intestinal canal pass to the lungs, and, if the dose of eggs is large, may even induce fatal pneumonia. The complete bearing as regards man—the normal host of *Ascaris lumbricoides*—of this observation is not quite apparent, but it certainly goes a long way to prove Sambon's view that, before attaining sexual maturity, the parasite must enter the tissues of its human host.

Filariasis.

In 1872 Timothy Lewis, in India, ascertained that the larval filaria discovered by Demarquay and Wucherer in pathological fluids was normally a parasite of the circulation. He called it *Filaria sanguinis hominis*. In 1876 Bancroft, in Australia, discovered the parental worm, *Filaria bancrofti*. Subsequently, in 1878, the writer ascertained that a Culex mosquito served as its intermediary host, abstracting the microfilaria from the blood and providing it with an opportunity for undergoing important developmental changes, during which it increases in size from a microscopic object to one just visible to the naked eye, and possessing an alimentary canal as well as remarkable powers of locomotion. In 1900 Low at the London School of Tropical Medicine, and subsequently James in India, made the important discovery that at this stage of development the larval worm passes into the labium of the mosquito's proboscis, and gets back into man direct, the old idea of the mosquito dying on the water and the embryos escaping into this medium and so reaching man, being thereby, if not absolutely disproved, rendered improbable. Noè, Grassi, and Fülleborn in the case of the allied parasite (*Filaria immitis*) of the dog, and Bahr in the case of the human parasite, have shown the exact mechanism of how this takes place. Finally, the metamorphosed embryos arrive at the lymphatics, where development is completed and the new generation of embryo filariae born.

When working in China at the life-history of the filaria I stumbled on the phenomenon known as "filarial periodicity." The microfilariae, I found, under normal circumstances come into the general circulation in the evening, increase in number till midnight, and gradually disappear towards morning, being almost entirely absent from the peripheral circulation during the day, when, as I subsequently ascertained, they lie up in the lungs and greater blood vessels. Stephen Mackenzie showed that by inverting the habits of the human host as regards the times of sleep this periodicity was correspondingly inverted, the filariae then coming into the peripheral circulation during the day and disappearing from it at night. For many years it was believed that this type of periodicity was observed by *Filaria bancrofti* embryos in all countries and climates. It certainly applies in most instances to China, India, Africa, and America, but we now know that it does not hold good for the islands of the Pacific—islands in which filariasis is particularly prevalent. Thorpe was the first to notice this, and later Lynch and others, especially Bahr, confirmed his observation in Fiji and elsewhere.

A larval filaria described by Ashburn and Craig in the Philippines in 1906 under the name of *Filaria philippinensis* has recently been proved to be only an example of *F. bancrofti*, adults from such cases being indistinguishable from the latter. Further, Leiper, after careful study, has failed to find any anatomical differences between the adult worms from Fiji and those from Asia and elsewhere. It seems to the writer that Bahr may have supplied the explanation of the discrepancy as regards periodicity between the ordinary and the Pacific microfilaria. This observer has shown that although in Fiji, as elsewhere, the night-feeding *Culex fatigans* is an efficient intermediary for the filaria, it is not the usual or most efficient intermediary in that group of islands. In Fiji the day-feeding mosquito, *Stegomyia pseudo-scutellaris*, is not only a very common insect but in respect of efficiency as an intermediary for the filaria is ahead of *Culex fatigans*, and he concludes that the filaria has partially adapted its habits to those of its favourite intermediary in the Pacific, just as it has adapted itself to the habits of *Culex fatigans* and other nocturnal mosquitos, its favourite intermediaries in Asia, Africa, and America. It may be suggested that the explanation might lie in some peculiarity of climate or other circumstance peculiar to Fiji and the Pacific islands generally; but the same writer has shown that the microfilaria of coolies imported from India, who, presumably, had brought their parasites with them from their native country, retained the nocturnal periodicity habit even after years of residence in Fiji, whilst Indians born in Fiji acquired the non-periodic filaria only. The point, however, is not settled, as *Culex fatigans* does exist and can carry the filaria in Fiji.

Although in many instances the filaria appears to be non-pathogenic, nevertheless, seeing that it is apt in a considerable proportion of instances to give rise to serious disease, especially elephantiasis, and that it occurs in a large proportion (5 to 75 per cent.) of the inhabitants of many tropical countries, it is a very important element in tropical pathology.

Many British workers have studied the pathological bearings of this parasite, and have definitely linked it up as the cause of lymphangitis, of chyluria, varicose groin and axillary glands, lymph scrotum, chylocele, various forms of lymphangiectasis and of tropical elephantiasis, and also of fatal septicaemia supervening on suppuration in abdominal and other seats of lymphatic varix. Of interest are the observations of Wise in Demarara, and Bahr in Fiji, on the cretified remains of effete filariae in the lymphatic glands and elsewhere.

Other Microfilariae.

As opportunity presented itself the writer made systematic examination of the blood of the natives of many different tropical countries, and in this way was enabled to discover the blood-haunting larval filariae of three additional and specifically distinct nematodes, namely, *Filaria loa*, *Filaria perstans*, and *Filaria demarquayi*.

The embryos of *Filaria (loa)*, the eye worm of tropical West Africa and its hinterland, and the cause of the peculiar condition known as "Calabar swellings," so common in Europeans in those regions, and so often mistaken for erythema nodosum, resemble very closely those of *Filaria bancrofti*. It differs, however, from the latter in minute anatomical details, and also in observing an exactly opposite periodicity, entering the general circulation during the day and disappearing from it at night. This circumstance led the writer to suggest that its liberating and intermediary host must be a biting fly of corresponding habit, and as the mangrove fly, *Chrysops dimidiata*, was very common and very active during the day in the endemic districts, he suggested that it might be the intermediary host, and therefore responsible for the spread of the parasite. This suggestion has been proved to be correct by Leiper, whose observations have been confirmed quite recently by Kleine in the Cameroons.

Acanthocheilonema perstans.

The larval form of this parasite was found in 1891 in the blood of a Congo negro suffering from sleeping sickness, and subsequently found in many cases of that disease. I concluded that it might be the cause of this condition, but Low and others have shown that this is not so. We now know that it is a very common parasite in West Africa, on the Congo, in Uganda, in British Guiana, and probably elsewhere in the tropics. Daniels was the first to find the adult worm in aboriginal Indians of British Guiana.

Filaria demarquayi.

The larvae of this species I found in the blood of the Caribs of St. Vincent, West Indies, and subsequently in aboriginals of British Guiana and possibly of New Guinea. Low has shown that it occurs also in others of the West Indian Islands—Dominica, Trinidad, and St. Kitts. He experimented with many insects to determine the intermediate host, but failed to find it. The adult form was discovered and described by Daniels in 1898. Whether the two last-mentioned nematodes produce any serious pathological effects has not been absolutely determined. It is unlikely that they do so.

Sprue.

Sprue is one of the more important diseases of the tropics, particularly as regards Europeans, among whom, especially among the older residents, it is a very common, very intractable, and very deadly disease. It is only of late years that its characters, symptoms, and diagnosis have come to be generally recognized, mainly through the writings of Fayrer, Thin, myself, Carnegie Brown, Begg, Castellani, and Bahr. The histopathology of the disease has been well worked out by British pathologists. There has been much speculation about the assumed specific cause—bacteria, hyphomycetes, and even helminths having been at different times incriminated; so far nothing definite in this respect has been arrived at. We are therefore still at a loss to indicate a scientific prophylaxis of a disease which amounts to a positive curse in such places as Ceylon, the Malay States, parts of India, of China, and of many other tropical countries.

The Dysenteries.

It is only of late years that anything approaching to a scientific conception has been attained of what is indicated by the term "dysentery." Formerly the word was taken to indicate one definite and distinct disease, but nowadays we must regard it as indicating several forms of colitis brought about by a number of specifically distinct disease germs. Thus we have protozoal dysenteries attributable to such germs as the *Entamoeba histolytica*, the malarial parasite, leishmania, and *Balantidium coli;* helminthic dysenteries resulting from invasion of the walls of the colon by *Schistosoma japonicum* and *Schistosoma mansoni;* bacterial dysenteries produced by the several members of the *Bacillus dysenteriae* group, and probably of other bacteria. Although most of the original discoveries which have enabled us to arrive at this classification of the dysenteries are to be attributed to workers other than British, some of them may be fairly assigned to our fellow-countrymen, especially those having a bearing on the prevention of these diseases, such as the elucidation of the part played by dysentery carriers and their treatment.

Beri-beri.

How many etiologically distinct forms of tropical multiple peripheral neuritis are included under the term "beri-beri" it is at present difficult to say; probably there are several. If we confine the term to that form of endemic multiple peripheral neuritis occurring in the Malay archipelago, China, and Japan, evidence is rapidly accumulating that, if it be not the only and sole cause of the disease, a dietary deficient in the vitamines essential for healthy nutrition has much to do with it. Although the initial observations which have led to this conclusion are to be credited to a Dutch physician—Eijkman—much has been done by British workers in narrowing the field for observation and in giving precision to conclusions. The observations of Eijkman on beri-beri in the Dutch East Indies distinctly indicated that in some way or other the disease was associated with a particular kind of prepared rice. Later Braddon insisted on this; and although his explanation of the *modus operandi* of the rice factor was not the right one, yet his insistence led to careful and fruitful investigation and experiment by Fraser and Stanton under Government auspices. The last named observers have distinctly shown that a leading element, if not the only element, in the causation of beri-beri, at all events in the Malay States, is absence (owing to excessive milling) of the pericarp and germ of the rice which constitutes the staple food of the Chinese, Indian, and Japanese coolie. And, further, they have shown that the administration of the millings of the decorticated and highly polished rice can arrest the development of a threatened attack of beri-beri, and, if it is not too far advanced, cure the disease. These observations on man are supported by experiment on the lower animals, especially on fowls, in which, as Eijkman and many others have shown, a diet exclusively of the incriminated forms of rice induces a polyneuritis closely resembling, if not identical with, that of beri-beri. The conclusions of Fraser and Stanton have been substantiated by many independent observers in the Philippines, in Japan, and elsewhere, and action based on these conclusions has had most happy results in prisons, asylums, hospitals, and other public institutions, as well as on native labour in plantation and mining camps. Mott, Halliburton, Durham, and Hamilton Wright have made important contributions to the pathology and anatomy of this disease.

Skin Diseases.

Mycetoma.—Since Vandyke Carter, in 1859, demonstrated the mycotic nature of the melanoid and ochroid forms of what is variously termed Madura foot, fungus disease of India, and mycetoma, considerable attention has been given to this and allied diseases by British and French pathologists, notably in Britain by H. J. Carter, Kanthack, Boyce, Hewlett, Adami, Kirkpatrick, and many others. Owing to the labour of these observers, it is now known that mycetoma occurs in many tropical countries besides India, and in a variety of forms, and that the germs are introduced through wounds in the skin.

Ulcerating granuloma of the pudenda was first described in India by McLeod, and in 1896 by Conyers and Daniels in British Guiana, and subsequently by other British workers in Africa, Australia, and elsewhere. Donovan called attention to certain coccoid parasites included singly, or more usually in groups, in the large mononuclear cells obtained by scraping the surface of the characteristic ulcers. Intravenous injections of antimony have lately been used with good effect in the treatment of this disease by workers in Brazil, and Low and Newham have recently published the details of a case in England cured by this method.

The systematic study of the tropical dermatomycoses had been neglected until recent years, and until the adoption of Sabouraud's methods by Castellani and Chalmers had brought about a certain amount of order into this little understood department of tropical dermatology. Other British workers have from time to time contributed to the advancement of the subject, and I may mention Turner and Sir William MacGregor. The tropical practitioner is no longer satisfied with a comprehensive diagnosis of the mycotic skin diseases by the expression "dhobie itch." He now recognizes that there is a great variety of hyphomycetic skin disease both in the native and in Europeans; he distinguishes between erythrasma, tinea cruris, tinea imbricata, pityriasis versicolor, and so forth, and he knows now that these are only a few of the many forms of hyphomycetic skin disease fostered by the heat and moisture of tropical climates and contact with tropical animals.

Vomiting Sickness of Jamaica.—For many years it has been known that a peculiar disease, called "vomiting sickness," occurs from time to time in certain districts in the island of Jamaica. It is an extremely fatal disease, the mortality being anything from 80 to 90 per cent. It occurs particularly in children, although sucklings are exempt. Naturally its etiology has been the subject of much speculation and several commissions have attempted to clear this up. Some have regarded it as a manifestation of yellow fever, others of malaria, but it has been reserved to Dr. H. Harold Scott, Government bacteriologist, Jamaica, to solve the mystery. He has found that the so-called disease is produced by poison liberated in some mysterious way in immature or damaged ackees, the fruit of *Blighia sapida* (a tree very common in Jamaica) and much used by the negroes of that island. Shortly after the consumption of damaged fruit, especially of the soup prepared from the damaged fruit, vomiting sets in; presently this subsides, to be followed three or four hours later by a recurrence and a rapid supervention of convulsions, coma, and death. The average duration of the illness is little over twelve hours. Dr. Scott has proved that certain animals are susceptible to the poison and show *post mortem* a remarkable fatty degeneration of the liver and other tissues, a condition which is also a notable feature in fatal cases of vomiting sickness in man.

Treatment of Tropical Diseases.

Many recent advances in our knowledge of the germ causes of tropical diseases and in our diagnostic methods have led to a more accurate application of certain drugs long recognized as efficacious in particular types of dysentery, and to the introduction of new drugs and methods of treatment in other diseases. I can allude to a few only of these drugs, and such as are justly attributable to British workers. The value of atoxyl in the treatment of trypanosomiasis was first indicated by Thomas, then of the Liverpool School of Tropical Medicine, and the use of salts of antimony in the same disease by Plimmer and Thomson of the Lister Institute.

Sir Leonard Rogers, following up Vedder's work on emetine, introduced this drug to be given hypodermically as a substitute for ipecacuanha in the treatment of amoebic dysentery and amoebic hepatitis. It has recently been demonstrated that this method does not, in many instances, sterilize the individual of his amoebae, and that many of these cases become chronic carriers. Quite recently, Dale, Low, and Dobell have used a new compound, emetine bismuth iodide, by the mouth in such cases, and have found its sterilizing effect on the amoebae to be much greater than that of emetine given by hypodermic injection. It is quite likely, therefore, that the oral administration will supplant the hypodermic method in the treatment of the disease in the future. Donovan and other British physicians have proposed radiotherapy in the treatment of granuloma of the pudenda, and many British practitioners in Africa and the West Indies have demonstrated the value of the intravenous injection of salvarsan and other arsenicals in tick fever and yaws.

INDIA AND MEDICAL PROGRESS.

BY

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To what extent has India contributed to the advancement of medical science?

In providing an answer to this question it is necessary to indicate that Western medicine, even at the present day, is represented in India by only about 1,000 British medical men, the major part of whom form the Indian Medical Service. One thousand British doctors in a land of over 300 million people! In a land where plague, pestilence, and famine are the crude problems of everyday life. In a land where tropical heat and torrential rains sap the vitality of the strongest frame and the resolve of the strongest will. In a land where strange diseases lurk in unsuspected places and death comes in a moment to even the most watchful.

To the teeming millions of such a land this small service has, since the earliest days of the East India Company, brought the benefits of Western medical science, carried into its waste places and most desolate outposts the standard of medical progress, and evolved sanitary order out of pestilent chaos. It has established medical schools and training colleges, and has brought into being an army of Indian-born and Indian-taught medical men. It has provided the professorial staff for the medical colleges, and has taught as well as practised the science and art of medicine and surgery. It has instituted a sanitary service, and has laid the foundations on which the science of tropical sanitation is built. It has established hospitals and dispensaries in every city and town in every district from Ceylon to the Pamirs, and has made it possible for twenty-eight and a half millions of India's people to receive the benefits of Western medical and surgical treatment in a single year. It has organized medical research and established research institutions where problems peculiar to India are studied by competent experts recruited from its own ranks. It has founded Pasteur Institutes for the treatment of rabies and the manufacture on a large scale of prophylactic vaccines and serums. It has ministered to the needs of India's army in peace, and tended to the sick and wounded in her frequent campaigns. It has organized the jail system of India, and taught her convicts trades. It has established tropical schools of medicine in Calcutta and Bombay, which bid fair to hold premier rank amongst such institutions in the world. All this the Indian Medical Service has done in the ordinary discharge of its duty, and what more?

Our knowledge of the natural sciences—botany, zoology, and geology—has been enriched by its aid. It has sifted from amongst the mass of tropical fevers a number of definite disease entities, described their etiology and symptomatology, and elucidated their cause or their mode of spread. It has made important contributions to our knowledge of other diseases of more universal distribution, discovered the means of cure of some of the tropics' most deadly maladies; and, finally, it has made striking additions to forensic medicine and to the art of surgery. It is with these, since they represent additions to the sum total of medical knowledge, that it is necessary to deal, emphasizing the fact, however, that they have been made during the performance of a task which in itself was colossal.

Let us consider, then, these contributions of India to the medical knowledge of the world.

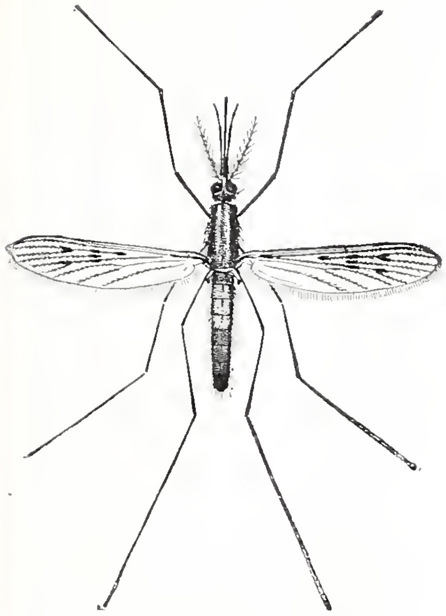

Fig. 1.—*Anopheles maculipennis*, a carrier of malaria in Europe.

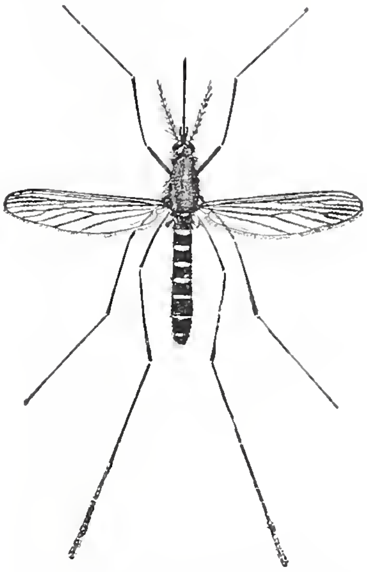

Fig. 2.—*Culex fatigans*, the chief carrier of elephantiasis.

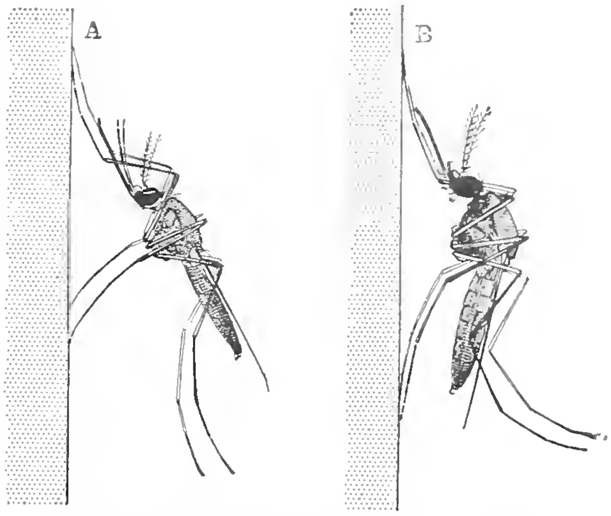

Fig. 3.—Sitting postures adopted by mosquitos. A, Anopheles; B, Culex.

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Malaria.

The discovery by Ross that the plasmodium of malaria is conveyed to man by anopheline mosquitos (Fig. 1) ranks not only as the greatest of India's medical triumphs, but as one of the greatest discoveries of modern times. As a result of this discovery it is now possible to control the spread of this disease, whereby an inestimable benefit has been conferred upon mankind. Through it a great light was shed upon the mode of spread by suctorial insects of other protozoal diseases, by which light the problems of the propagation of dengue, yellow fever, sleeping sickness, and other diseases of the tropics have reached, or are gradually reaching, solution. Truly Ross's achievement was epoch-making, and laid the foundation on which the science of tropical hygiene is built. By its aid some of the earth's most pestilent places have been made habitable. Witness its triumphs in the Panama Canal zone, in India, in East and West Africa, and in Greece, Italy, and Egypt—triumphs which Ross's discovery alone made possible.

Ross, whose services to humanity have received the highest recognition of almost every country in the world, including the award of the Nobel Prize, has been followed in India by others whose researches have brought to light the important truth that different species of anopheles are responsible for the spread of malaria in different localities, as, for example, *Noccellia stephensi* in Bombay and *Pseudomyzomyia ludlowi* in the Andaman Islands. Accurate studies of the habits and breeding places of different species of anopheles have enabled tropical sanitarians to conserve their energies to the destruction of the responsible mosquito in each locality.

In the treatment of this disease by quinine the pioneer work of Edward Hare, and in more recent years of MacGilchrist, must not be forgotten—the former, by introducing, in 1847, the practice of giving quinine without waiting for remission, was instrumental in saving many lives and in putting to an end the pernicious, and then universal, system of bleeding in this disease; the latter, by his careful researches on the value of different products of quinine, has added greatly to our knowledge of its treatment and to the treatment of blackwater fever.

Kala-azar.

To the patient researches of Donovan, of the Indian Medical Service, the world owes the discovery of the causal agent of this malady, and the recognition of *Leishmania* as disease-producing agencies. More recently Patton and Mackie, of the same service, have brought forward experimental and other evidence which goes far towards elucidating many of the complex problems connected with its spread. Younger members of the service have also added greatly to our knowledge of the epidemiology of this deadly malady.

Other Tropical Fevers.

It was Vandyke Carter who in India worked out the origin and development of the disease known as famine fever, relapsing fever, or spirillum fever; and Mackie who, in more recent years, discovered that *Pediculus vestimentorum* was its carrier.

To this service is also due the credit of having separated three-day fever of Chitral—now known as sandfly fever—and seven-day fever of Calcutta, from amongst the mass of the unclassed fevers of the tropics, and of indicating the sandfly as the probable source of spread of the former malady, an indication which later researches in other countries proved to be fully justified.

Plague.

It is to India that the world owes its knowledge of the rôle played by the rat and by the rat-flea (Fig. 4) in the propagation and spread of bubonic plague—discoveries which were placed upon the statute book of medical progress by Liston and Bannerman of the Indian Service and by the Indian Plague Commission. As a result of these discoveries, it has been possible to prevent the spread of plague in countries whence it has been carried in ships and merchandise from India. Furthermore, protection is afforded to the individual in plague-stricken countries by the method of prophylactic inoculation with killed cultures of the bacillus—a method which was introduced at Bombay in the year 1897 by Haffkine of the Indian Service.

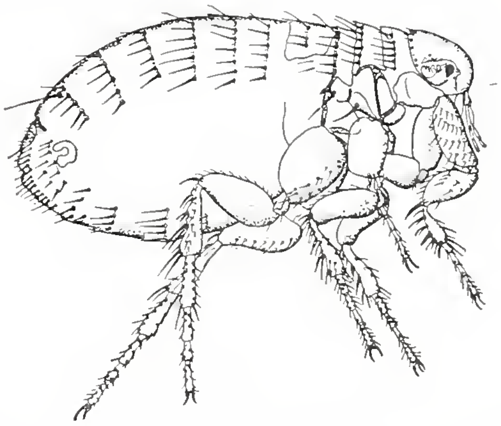

Fig. 4.—The rat-flea (*Xenopsylla cheopis*), a carrier of plague.

Cholera.

It is to India that the world owes a great part of its knowledge of cholera, and the whole of its knowledge of the treatment and mode of spread of this deadly malady. Leonard Rogers, amongst his other monumental contributions to tropical medicine, has, by his hypertonic saline treatment of cholera, robbed it of half its terrors, and reduced its mortality from 70 to 23 per cent. Greig, by demonstrating the cholera vibrio in the lungs, the liver, and other tissues, as well as in the urine, has within the last few years provided a wealth of information in regard to the human factor in its dissemination. He has shown that cholera can no longer be regarded as solely water-borne, and that the human subject is the reservoir and the carrier of its infective agent (Fig. 5).

To India also belongs the honour of having perfected, through Haffkine, as early as 1893, a method of anticholeraic inoculation the protective value of which has proved of the highest value.

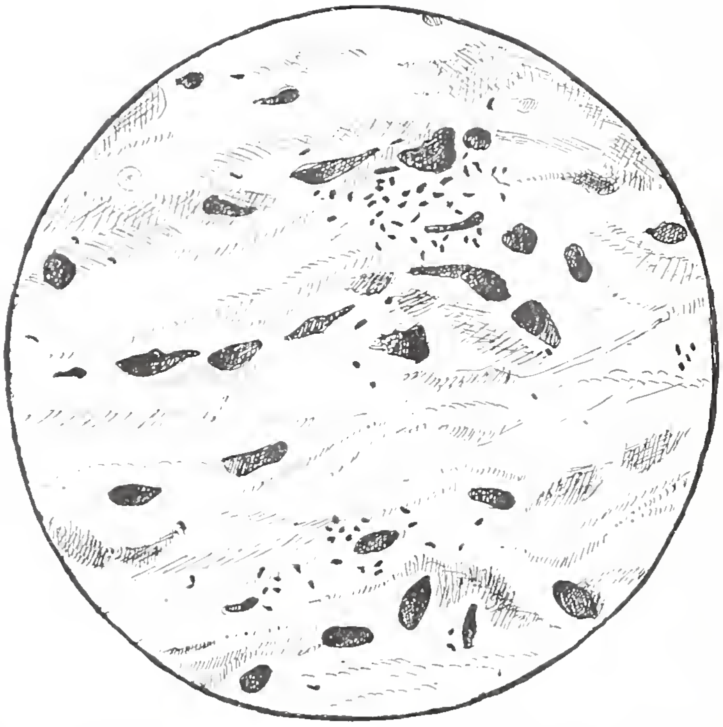

FIG. 5.—Section of wall of urinary bladder showing the cholera vibrio in the submucosa. The round cells infiltrating the submucosa are also shown. (Greig.)

Dysenteries.

For the major part of its knowledge of the treatment of the dysenteries the medical profession of all lands is indebted to India. Buchanan's introduction of the saline treatment of bacillary dysentery provided a weapon of wonderful effect against this form of the disease; and even now that serum-therapy affords a specific means of cure the saline treatment remains such a reliable addition to our armamentarium as can ill afford to be dispensed with.

Few discoveries in the field of therapeutics have been of such signal service to mankind as that of the specific action of emetine hydrochloride when administered hypodermically in amoebic dysentery—a discovery for which we are indebted to Leonard Rogers of the Indian Medical Service. The simplicity of this method of treatment and the certainty of its action when properly administered has reduced the mortality of this disease to an enormous extent. It has provided an effective prophylactic measure against the occurrence of those dangerous complications of amoebic infections of the bowel, *hepatitis* and *liver abscess*, and an efficient means of their cure, while it has greatly reduced the necessity for operation in amoebic infection of the liver, simplified our operative procedures, and reduced their risk.

Rabies.

India also, through its British medical men, has added greatly to our knowledge of the Pasteur treatment of rabies, and has improved upon that of Pasteur himself. In one of India's Pasteur Institutes alone as many cases are treated in a single year by these improved methods as in the whole of the rest of the world put together.

Leprosy.

India has within recent years made notable advances in the treatment of her lepers—advances which hold out the confident hope of the early evolution of a means of cure of this unclean and fatal malady. (Figs. 6 and 7.)

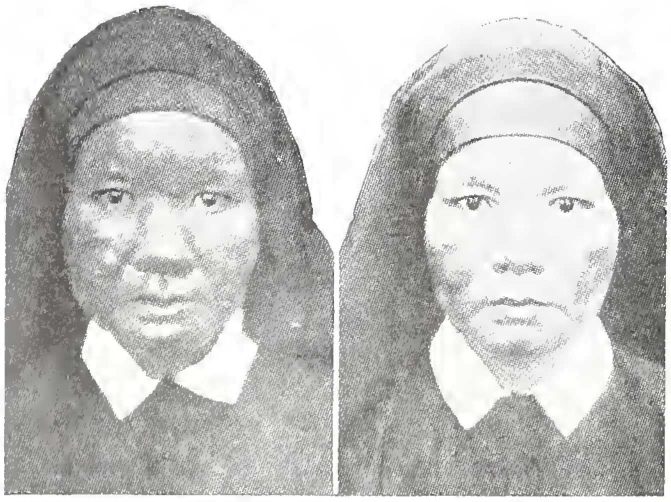

FIG. 6. FIG. 7.

The treatment of leprosy by vaccines (Rost). Fig. 6, Before treatment. Fig. 7, After treatment.

Goitre and Cretinism.

In the elucidation of the mystery which from the time of Hippocrates has surrounded the origin of these diseases of the thyroid and parathyroid glands, India has, within the last ten years, been able to play a notable part. Research has shown that intestinal organisms are the agencies mainly responsible for their production. (Figs. 8, 9, 10, and 11.)

The Natural Sciences.

In the field of botanical research the work of Hill and Prain, to mention only two of India's botanists, has added greatly to our knowledge of the flora of the tropics, while Bose, an Indian-born subject, has gained for himself a pre-eminent place in connexion with his studies of plant physiology.

In the domain of zoology the Indian Medical Service has provided such authorities as Day, Alcock, and Wall, who have greatly enriched our knowledge by the study of deep sea fauna and of reptilia, to mention but two fields of their activities. Modern Indian investigators also have done much to classify and describe many new species of malaria-bearing and other mosquitos; while such geologists as Falconer and MacClelland have rendered the greatest services in contributing to our knowledge of the earth's crust.

Hypnotism.

And let it not be forgotten that even before British medical science had given to the world the incalculable blessing of anaesthesia James Esdaile, of the Indian Medical Service, had demonstrated the miraculous utility of mesmeric anaesthesia, under which he performed painlessly hundreds of operations of great gravity. The use of ether and chloroform has overshadowed Esdaile's brilliant discoveries, but these will find their place again in the armamentarium of the scientific physician and surgeon of the future, and their application in the relief of human suffering will go far to extract from the chaff of Christian Science and faith healing the full ears of wheat which lie buried in them.

Surgery.

Finally, in general surgery the members of the Indian Medical Service and their pupils have conferred such benefits on the people of India as to leave one awe-struck at the magnitude of their operative work. No less than 1,050,000 of India's people received the benefits of surgical treatment in a single year. India's surgeons have never departed from the teachings of the father of all modern surgery —Lord Lister; they have continued to recognize the value and the place of antiseptic, as opposed to aseptic methods, in the treatment of surgical conditions in the tropics, where wounds are so subject to soil infection. To them the surgical lessons of the present war have come as no surprise, while they have long recognized and practised the prophylactic use of antitetanic serum in such conditions as compound fractures and other infected wounds. So much so is this the case that deaths from tetanus in Indian hospitals, which were formerly frequent, have been reduced to a minimum.

But there are three departments of surgical practice in which Indian surgeons have led the world, and in which their supremacy is indisputable—litholapaxy, ophthalmology, and rhinoplasty. With the perfection of the first for the cure of vesical calculus, the names of Keegan and Freyer must be associated for all time. This procedure has led to the abandonment of the practice of cutting for stone, and has added to the art of surgery a method of treatment of the highest value.

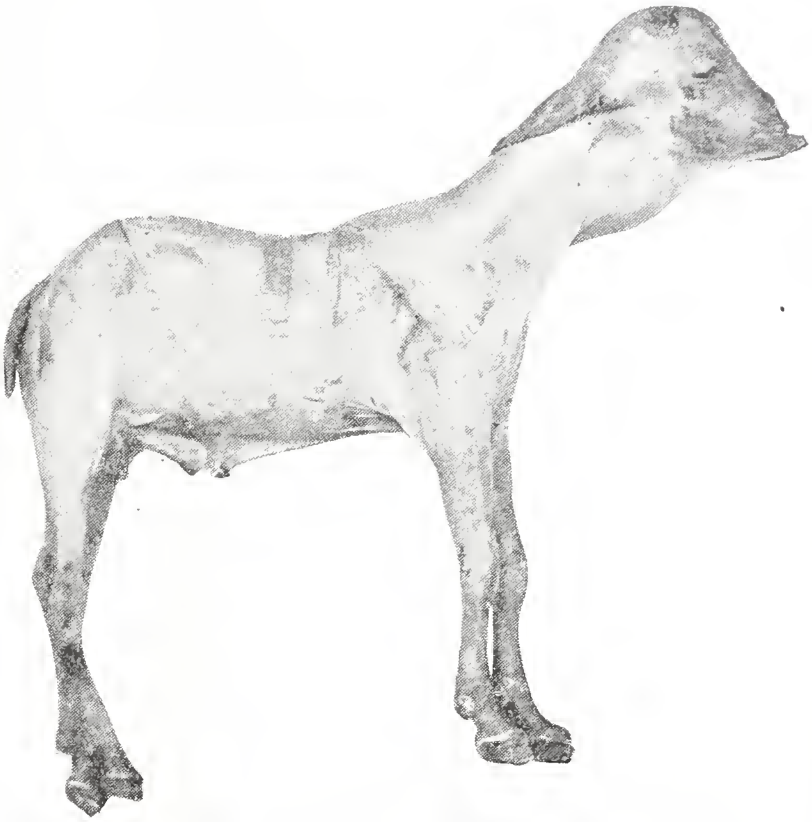

FIG. 8.—Experimentally produced congenital goitre in kid (McCarrison).

The methods of ophthalmological practice, especially in regard to the treatment of cataract and glaucoma, which the world owes to such men as Maynard, Herbert, Elliot and Smith, have brought to India's shores students from all lands, and conferred inestimable benefits upon mankind.

Plastic surgery of the face also owes much to the unrivalled experience of Indian surgeons, and the methods of technique evolved by them are now largely employed by modern military surgeons in the present war. Keegan's writings on rhinoplasty are amongst the most important contributions to this subject to be found in the literature of modern surgery.

The Present War.

And in this conflict of nations, to what extent have India's contributions to medical science aided in lessening its terrors and alleviating its pains? Witness the ravages of bacillary and amoebic dysentery in the armies of all belligerents, and the blessings which the Indian treatment by salines and by emetine have proved themselves to be. It is not too much to say that thousands of lives have been saved by these means. It is to the emetine treatment of amoebic dysentery also that the rarity of its dreaded sequel — liver abscess—is to be attributed. Witness also the check which protective inoculation by vaccines has placed upon the spread of plague and of cholera in Gallipoli—a method of protection which was inaugurated in India. The results achieved by this means are all the more remarkable when it is remembered that plague and cholera were prevalent amongst the Turks in the near neighbourhood of the allied troops during the Gallipoli campaign. It is due to Indian medical research to emphasize the fact that it was Haffkine's work in the years 1893–7 which preceded and inspired research on the prophylactic use of vaccines against bacterial diseases. The success which has crowned the use of antityphoid inoculation is a striking example of the far-reaching effect of scientific methods which had their origin in India. Witness also the important part which their knowledge of the human factor in the spread of cholera has enabled Indian medical officers to play in the prevention of outbreaks of cholera in Mesopotamia, and in the cutting short of others amongst those who had not received the benefits of protective inoculation. And witness the great reduction in the usual high rates of mortality of cholera amongst those who developed the disease which Rogers's hypertonic saline treatment alone made possible. Relapsing fever, also, which made its appearance amongst the troops in the Eastern Mediterranean, was early exterminated owing to our knowledge of its mode of spread by the body louse—a knowledge which India has been instrumental in providing. And, in a lesser degree, it has been possible to afford the troops protection against sandfly fever, which, although a non-fatal malady, is capable of materially reducing the numbers of effectives in a susceptible community and of predisposing to maladies of greater gravity.

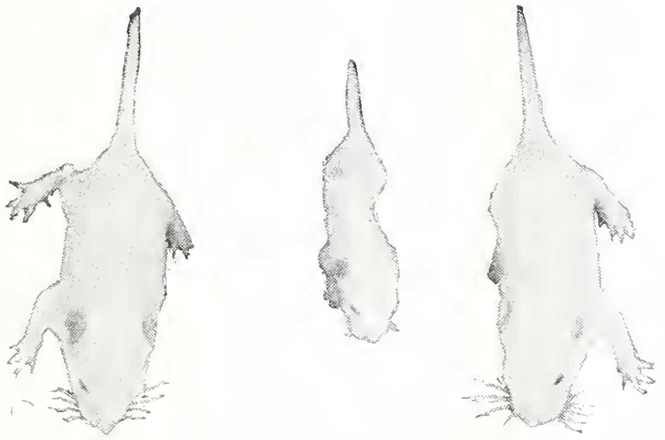

FIG. 9.—Experimentally produced cretinism (McCarrison). A litter of three young rats aged 20 days; the animal in the centre is a cretin.

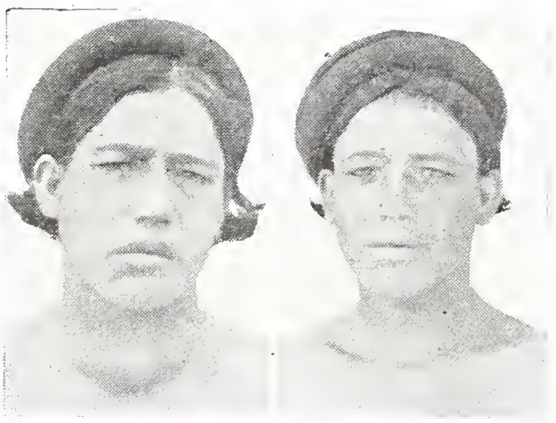

FIG. 10. FIG. 11.

The treatment of goitre by autogenous vaccines prepared from intestinal bacteria (McCarrison). Fig. 10, Before treatment. Fig. 11, After treatment.

These are amongst the benefits which India may proudly claim to have made available for friends and foes alike in the present war. Truly her medical service has triumphantly borne into the pestilential places of the earth the standard of medical progress, and has emblazoned on its folds such victories over disease as no other country's medical service can boast. Malaria, tropical fevers, plague, cholera, dysentery, liver abscess—these are amongst its conquests; while across the art of general surgery and of ophthalmology the service has written its name in imperishable letters.

CHAPTER XII.

INFECTIVE JAUNDICE (SPIROCHAETOSIS ICTEROHAEMORRHAGICA).

BY

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HISTORICAL ACCOUNT.

EPIDEMICS of jaundice have been described from the earliest times, and many of the best accounts have been compiled from the study of the disease in armies in the field. Cockayne draws attention to the fact that the author—probably Hippocrates—of the *De Internis Affectionibus* describes Ἄλλος ἴκτερος. *ἐπιδήμιος οὗτος καλέεται, διότι πᾶσαν ὥρην ἐπιλαμβάνει.* In 1745 Cleghorn described an outbreak of epidemic jaundice in Minorca, and Larrey, in 1800, published an account of an epidemic of jaundice during the siege of Cairo, and drew particular attention to the contagiousness of the disease and to the occurrence of haemorrhages in his patients. Amongst French writers, Ozanam (1846–9), Monneret (1859), the elder Laveran (1865), Lancereaux (1882), Landouzy (1882), and Mathieu (1886), have all described epidemic diseases of varying intensity in which jaundice was a constant feature. Lancereaux described his cases under the title of "Ictère grave essentiel," and Landouzy called the disease "Fièvre bilieuse," and Mathieu, drawing attention to the frequent occurrence of relapses, gave to his description the title of "Ictère fébrile à rechutes." The accounts of the diseases described by these authors vary, and it is probable that there were different etiological factors in each epidemic.

Attention may be drawn, however, to certain descriptions in so far as they throw light upon the particular type of epidemic jaundice which is to be described in these pages. In 1859 Carville described an epidemic in the garrison at Gaillon, and gives an account of 47 cases, of whom 11 died. All developed jaundice, and albuminuria was present in every case. Haemorrhages were common; 15 had epistaxis, in 3 there was purpura, and in one haematemesis. The incubation period was six days. A similar epidemic was described by Worms in St. Cloud in May, 1865.

Mathieu in 1886 described cases of jaundice and drew attention to the fact that the term "catarrhal jaundice" was an insufficient description, and claimed that the fever general symptoms, enlargement of the spleen and albuminuria, justified the title of infectious jaundice.

Weil in 1886, and some months after the publication of Mathieu's report, described four cases of infectious jaundice, and drew attention to the relapses of fever which occurred in two out of the four cases. From this time onwards the symptom-complex of fever, jaundice, enlargement of the liver and spleen, the occurrence of haemorrhages, and occasional febrile relapses, have been described under the name of Weil's disease. This last title has served the purpose of labelling with a simple name any disease which embraced the signs and symptoms which we have just enumerated. Both historically and scientifically the title is incorrect and vague. Epidemic jaundice was described by the Father of Medicine, and his disciples in later years have only added little by little to a clinical picture which is still far from being complete. There is no doubt that there are many and different etiological factors which can give rise to a clinical picture in which fever, jaundice, haemorrhages, enlargement of the liver and spleen, and relapses of fever are variously, but not constantly, present. In none of the descriptions quoted above is the picture complete. In none has the cause ever been proved, and in many it is not even suggested. During the last three years, however, we have been enabled to recognize a form of infectious jaundice in which the clinical and pathological picture is uniform and constant, and of which the cause has been discovered and proved.

In November, 1914, two Japanese workers, Inada and Ido, showed the presence of a spirochaete in the liver of a guinea-pig which had been inoculated with the blood of a patient suffering from a form of infectious jaundice. Some months later they proved the specificity of this spirochaete, and gave to it the name of *Spirochaeta icterohaemorrhagiae*. In a later part of this paper the work of these Japanese authors is set forth in greater detail. In the British and French armies it has been shown conclusively that an infectious disease usually accompanied by jaundice is caused by the *Spirochaeta icterohaemorrhagiae*, and descriptions of the clinical and pathological findings have been published by Dawson and Hume, Stokes, Ryall, and others in the British army; and in the French army by Martin and Pettit, Garnier and Reilly, and Costa and Troisier.

Jaundice has been a relatively common disorder in armies in the field. In the Federal troops in the war between North and South America there were 22,509 cases, with 161 deaths, amongst a total of 2,218,559 men. In 1870, from February to May, there were 799 cases amongst 33,380 men in the Bavarian troops stationed to the south-west of Paris. During five months in the South African war there were 5,648 cases, with a small mortality. We have been unable to ascertain the incidence of cases of jaundice amongst the British and French troops in France.

Before we received the Japanese work we were able to prove that certain cases of jaundice belonged to the enteric group of diseases. In the summer and autumn of 1915 our attention was arrested by the occurrence of severe cases of jaundice in which there were high fever, haemorrhages, enlargement of the liver, and a tendency to febrile relapses, which in no way conformed either clinically or bacteriologically to the typhoid group.

In the autumn of 1915 we made a special endeavour to study these cases by collecting them into a single hospital, and the result of our work has been published in detail in the *Quarterly Journal of Medicine*, October, 1916, and January, 1917. It was only in April and May, 1916, that we were able to show that the *Spirochaeta icterohaemorrhagiae* was the cause of this disease, after we had read the account of the Japanese work published in the *Journal of Experimental Medicine*.

CLINICAL DESCRIPTION OF THE DISEASE.

In order to draw attention to the characteristic features of this disease, a case will be briefly described and an account of the chief signs and symptoms will be set forth under the headings of the various systems of the body.

On August 7th, 1917, Pte. A. B. was suddenly seized with vomiting and diarrhoea, with a feeling of intense weakness. For two days he lay in his billet with a temperature of 103° to 104° and had frequent diarrhoeal stools. On August 9th the prostration was very marked and there was a considerable amount of blood in the stools. The temperature was 101°. On August 12th he was noticed to be jaundiced. On August 14th he had an attack of haemoptysis and spat up about one pint of blood, and the expectoration was blood-stained for the following five days.

On admission to a base hospital on August 16th, there was universal intense jaundice and the temperature was 101.2°. There was a scabby mass of haemorrhagic herpes about the lips. The tongue was brown and very dry. The patient was drowsy and there was considerable abdominal distension and discomfort. The initial diarrhoea was followed by constipation, which necessitated the use of enemata. There was marked tenderness in the right hypochondrium and the liver was enlarged to three fingerbreadths below the right costal margin. The spleen was not palpable. The red blood cells numbered 4,800,000 to the cubic millimetre and the haemoglobin was 80 per cent. The white cells numbered 24,000 to the cubic millimetre and a differential count showed :

Polymorphonuclear leucocytes	82 per cent.
Lymphocytes	10 ,,
Large mononuclear leucocytes	5 ,,
Coarsely granular eosinophile leucocytes ...	3 ,,

The urine was loaded with bile, and there was a sixth of a boiled test tube of albumin together with granular casts. Some bile was escaping into the duodenum, as the stools were of a light brown colour.

There were crepitations to be heard over the lower lobes of the lungs. There was no recurrence of haemoptysis or melaena. During the first fortnight of the illness the patient complained much of pains in the back and limbs. On August 20th the temperature had fallen to 98° to 99°, though the jaundice was still intense. On August 26th the jaundice was rapidly fading, and on this day spirochaetes were found in the urine in large numbers. During the next five days the general condition of the patient improved so much that he was sent to England on August 31st. There was no secondary rise of fever while the patient was in France.

Such is the usual history of a case of moderate severity, and the noteworthy features are the following : A sudden onset with gastro-intestinal symptoms and high fever, the marked prostration, the occurrence of melaena and haemoptysis, the presence of haemorrhagic herpes, the appearance of jaundice on the fifth day, the fall of temperature at the end of eleven days, and the finding of typical spirochaetes in the urine.

General Features of the Disease.

The Onset.—The patient has almost invariably been attacked by the disease either in the trenches or immediately after having left them. The onset is usually sudden, with shivering, pains in the head and particularly behind the eyes, generalized pains, and a feeling of extreme prostration. So sudden is the onset that the patient can frequently point to an exact moment when he finds himself overcome ; as one said, he "fell out very weak" on the march ; or in another instance, he "suddenly collapsed at church parade." At the time of reporting sick the temperature is raised to 103° to 105° and the pulse rate is about 100 per minute. During the first two or three days before the appearance of jaundice there are vomiting, great prostration and lassitude, with abdominal and muscular pains. The conjunctivae are injected, and herpes, which rapidly becomes haemorrhagic, appears on the lips.

Gastro-intestinal.—A dirty, brown tongue and anorexia is common to all ; constipation is the rule, and it is only rarely that there is diarrhoea at the onset, as in the case described above. The constipation is usually extreme and has to be relieved by enemata. The stools may become clay-coloured, though in most cases the presence of a small quantity of bile gives the stool a light-brown coloration. Usually there is considerable abdominal tenderness, which is more marked in the upper than in the lower abdomen. Though vomiting is usual at the onset, it generally ceases before the patient reaches a base hospital, on the sixth to eighth day of the disease. Hiccough was occasionally present in very severe or fatal cases. Melaena sometimes occurred in patients with diarrhoea.

The liver is frequently enlarged to the extent of three fingers' to a hand's breadth below the right costal margin and the tissues covering it are usually very sensitive and tender.

The spleen has only been palpable on two occasions in our experience. From observation at operation and from the size of the organ at *post-mortem* examination it seems certain that the spleen is very rarely sufficiently enlarged to be palpable.

The superficial lymphatic glands are frequently palpable in the axillae and groins.

Haemorrhages.—Out of eighteen severe cases under our care, fourteen had haemorrhages. Haematemesis occurred in four and haemoptysis in six. Epistaxis was considerable in four cases and slight in two cases. Melaena was observed in three instances and in three there was a marked purpuric eruption in the skin. In one patient there were epistaxis, haemoptysis, and melaena.

The Skin.—The jaundice usually appears about the fourth day of disease and gradually deepens up to the eighth or ninth day and then fades. In some cases it is very intense and the skin takes the greenish hue met with in complete obstruction of the common bile duct. Herpes labialis, which is haemorrhagic, occurs in at least 40 per cent. of all cases. Pruritus is rarely intense, though patients frequently complain of some itching. The conjunctivae are often injected and the eyeballs are tender.

The Circulatory System.—The rate of the heart does not increase in proportion to the rise of temperature, and in severe cases with a temperature of 104° to 105° the pulse-rate may be only 100 per minute. The rhythm of the heart is not usually affected, except in one patient, in whom auricular fibrillation, of which records were obtained, persisted for five days. The size and sounds of the heart are perfectly normal. The blood pressure never falls as it does in the enteric group of diseases, and the systolic pressure ranges about 120 mm. of mercury. The qualitative changes in the peripheral blood will be described in the section on clinical pathology.

The Respiratory System.—In all severe cases there are the evidences of an acute bronchitis, but we have never discovered any signs pointing to bronchopneumonia or lobar pneumonia. Reference has already been made to the occurrence of haemoptysis and rusty sputum. The respiratory rate may be increased to 28 or 30 per minute in severe cases, and in fatal cases the type of breathing is that met with in cases of cholaemia and uraemia.

The Nervous System.—Frontal headache and aching behind the eyeballs is a constant complaint, and is little relieved by antipyretics. The early weakness and prostration are very characteristic of this disease. In our fatal cases twitchings and convulsions preceded the coma in which the patients died. In many cases the muscular pains are very intense, and the whole body is so sensitive that the patient cannot bear any pressure upon it. One patient complained of xanthopsia.

The Urinary System.—Three of our patients had retention of urine, which required the use of the catheter for two or three days. The cause of this disability probably lay in the central nervous system. The urine usually contains a large quantity of bile, which sometimes gives it a dark porter colour. The bile does not usually disappear from the urine till the end of the fourth or fifth week. Albumin can nearly always be detected by the boiling method. In more severe cases, after heating in a test tube and allowing it to stand for twenty-four hours, the albuminous deposit amounts to one-sixth of the boiled test tube. Casts, hyaline and granular, are frequently found without centrifugalization, and at times free blood cells are seen in the deposit. The presence of reducing sugar was never detected, though acetone is said by others to occur in cholaemic cases, probably the result of starvation. The chemistry of the urine has been fully worked out in this disease by certain French authors, who lay considerable stress on the evidences of renal insufficiency.

The Fever.—The initial rise of temperature to 103° or 105° has already been noted, and during the first twelve or fourteen days there is an irregular range of temperature between 100° and 103°, which gradually falls by lysis to normal or subnormal. After the fall the temperature may be subnormal for two to three days. After this, in some cases about the beginning of the third week, there is a secondary rise of temperature, which lasts for ten to fifteen days. During this period of secondary fever there are usually no evidences of exacerbation of symptoms, and it is difficult to account for its occurrence. In those cases in whom there is no secondary fever the temperature may swing about 99° for a week or more before finally settling to the normal. Chart I shows a characteristic fever of relapse.

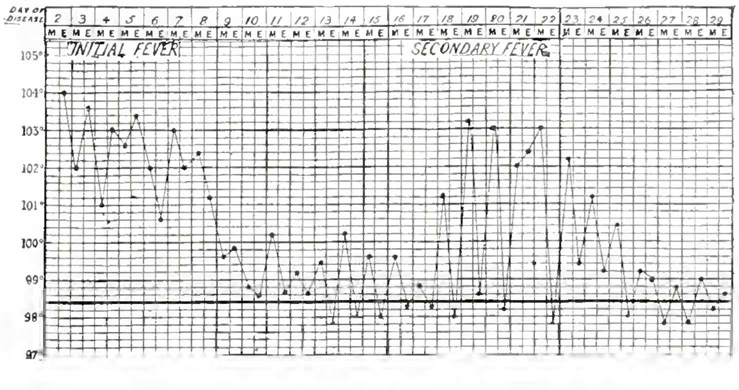

Chart I.

Course of the Disease.—The first three or four days have been described in the section on the onset of the disease. The jaundice, which has appeared about the fourth day, gradually increases, and is most intense about the tenth to twelfth day. It is then that the temperature falls to normal. In uncomplicated cases the patient begins to improve and the jaundice begins to disappear at the end of the second week. Between the third and fourth weeks convalescence has become established. The whole disease is more protracted in severe cases, and convalescence may not begin until the end of the fourth week. As far as we know, the disease leaves behind it no untoward symptoms.

The following is an account of a fatal case:

Pte. C. D. was taken ill with a sudden chill and shivering on December 16th. He had to take to his bed, and complained of headache, nausea, and pains in both thighs. He frequently felt chilly and had pain in the epigastrium. On December 21st he became jaundiced. On this day no abnormal physical signs could be detected in any of the systems, except some epigastric tenderness, jaundice, and a haemorrhagic herpetic eruption on the lips. Vomiting had been occasional from the onset of the illness, and at the end of the first week nothing could be retained in the stomach. After the seventh day the jaundice steadily deepened and the urine was loaded with bile and contained one-sixth of a boiled test tube of albumin. The stools were liquid and of a pale yellow colour.

Except on the first day of admission to a base hospital (fourth day of disease), when the temperature was 101°, there was no pyrexia, and both the pulse and respiration rates fell, to 60 and 16 respectively. There was considerable tenderness of the upper abdomen and the muscles were slightly rigid. The liver was enlarged and the edge extended three fingerbreadths below the costal margin. The spleen was not palpable. An examination of the blood showed 34,100 white cells per cubic millimetre, and the differential count was:

Polymorphonuclear leucocytes ...	93 per cent.
Lymphocytes	6 ,,
Large mononuclear leucocytes ...	1 ,,

A culture made from the urine was sterile. The faeces showed some blood, but no parasites, no ova, and no organisms of the enteric group were detected.

In the forenoon of December 29th some twitching of the face and arms was noticed, and about an hour later the patient had a general tonic, followed by a clonic, convulsion. The patient died one hour after this convulsion. The most noteworthy lesions at the *post-mortem* examination were subendocardial, subpleural, and subperitoneal haemorrhages and large extravasations of blood into both lungs, like infarcts.

Prognosis.

Most cases recover fully, and we would estimate that the mortality is not more than 4 to 5 per cent.

Treatment.

Thus far the treatment has been purely symptomatic. During the febrile period the patient is encouraged to drink large quantities of fluid, and an alkaline mixture is usually exhibited. Constipation is combated either by saline purges or by enemata. Salvarsan has been tried, but it is of no avail. We believe that the serum of convalescent patients has been injected into the blood stream of severe cases, but the results of this method of treatment are not in our possession. An antiserum has been prepared and is available for use in the army.

Differential Diagnosis.

The rôle of the *Spirochaeta icterohaemorrhagiae* in this disease is discussed at some length, and the proof that it is the causal agent is established in a later part of this paper. We may anticipate by here stating (1) that the spirochaete may be found in the human peripheral blood stream; (2) that injection of infected human blood into the peritoneal cavity of the guinea-pig may produce a characteristic fatal illness in that animal, in whose tissues *post mortem* the spirochaetes are present in large numbers; (3) that after the first fortnight of the disease the spirochaete may be found in the patient's urine.

In the early stages of this disease the most rapid and the most certain criterion in diagnosis lies in the discovery of the spirochaete in the peripheral blood stream. As the incubation period of the disease in the guinea-pig is at least six days, it would require a wait of at least eight days before the development of the disease in the guinea-pig could establish the diagnosis. After the second week of illness the discovery of the spirochaete in the urine is sufficient evidence of the disease. These various criteria presuppose the employment of complete bacteriological equipment in the hands of experienced observers. These are not always at hand, and reliance has to be placed on the correct interpretation of the clinical signs and symptoms. The sudden onset with headache, generalized pains, and a sense of utter exhaustion, vomiting, conjunctival congestion, herpes labialis, and a temperature of 103° to 104°, with jaundice appearing on the fourth or fifth day, make the diagnosis of spirochaetosis icterohaemorrhagica almost certain.

In France the chief causes of jaundice have been the *Spirochaeta icterohaemorrhagiae*, and members of the enteric group of organisms. Jaundice in typhoid or paratyphoid fever usually appears about the end of the second week. There are cases, however, of paratyphoid fever in which the jaundice appears as early as it does in spirochaetosis icterohaemorrhagica. The difficulty in diagnosis is then considerable. At the end of the first week help can be obtained in differentiating the two diseases by means of the atropine test. This test was introduced in the diagnosis of typhoid fever by Captain H. F. Marris, R.A.M.C. One-thirtieth of a grain of atropine sulphate is administered hypodermically, and the increase of pulse rate is recorded every minute for the following hour. If the rate of the heart only increases by ten beats or less, this is evidence that the patient is suffering from typhoid or paratyphoid fever. It is important to bear in mind that the rate of the heart before the injection must not be above 80 to 85 per minute. If the rate increases from 100 to 110 or 115 after the injection of atropine sulphate it is impossible to be certain whether the escape of 10 to 15 beats indicates a positive or negative result. It is rare that the organism can be isolated from the blood in the prevailing enteric group of diseases. In inoculated patients it is necessary to trace the agglutination curve from three to four readings. This means a delay of at least fourteen days after the first sample of blood has been taken.

Apart from these specific methods of differential diagnosis or the presence of a typical clinical picture there can be mere speculation.

Spirochaetal Infection without Jaundice.

It is almost certain that many cases of "P.U.O." in France have been due to the *Spirochaeta icterohaemorrhagiae*, and in the absence of jaundice the difficulty in diagnosis may be great. It is becoming more generally recognized that this same spirochaete may give rise to a clinical picture in which there is an absence of jaundice. The following case illustrates this point.

Sudden onset with body pains, frontal headache, photophobia, and vomiting. Temperature on the first day 104°, pulse 100, and the patient was very ill. The conjunctivae were injected; herpes labialis was present, the spleen was not palpable; the urine showed on heating a thick cloud of albumin, but no bile. Bilious vomiting was persistent for several days.

By the fourteenth day the patient appeared convalescent, but on the twentieth day there was a return of fever and pains, which lasted for five days. After this recovery was slow, but continuous. Nine weeks after the onset spirochaetes were still present in the urine, though health was nearly re-established. At no time was there jaundice or bile pigment in the urine.

On the third day of illness 2½ c.cm. of the patient's blood were injected into the peritoneal cavity of a guinea-pig, which subsequently developed jaundice, and after death spirochaetes were to be seen in the sections of its liver.

For most of this record we are indebted to Captain H. Carson, R.A.M.C.

Costa and Troisier have shown that in certain cases which present meningeal symptoms the cerebro-spinal fluid produces the characteristic disease in the guinea-pig. It is therefore necessary to bear this fact in mind in the elucidation of any case of fever presenting pronounced meningeal signs and symptoms.

It is unnecessary to pursue the differentiation of this disease with jaundice from the common affections of the biliary system associated with jaundice. Nor is it necessary to mention the various febrile diseases which

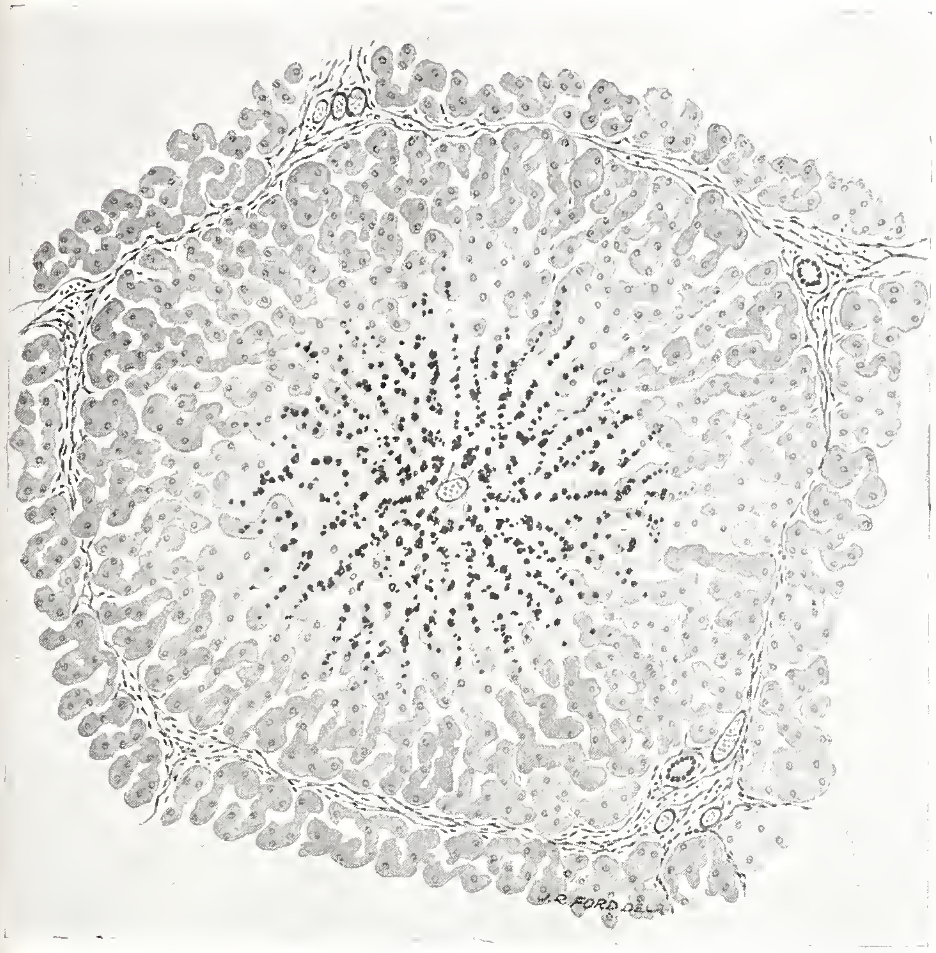

FIG. 1.—Section of liver from a case of spirochaetal jaundice. The liver cells and their arrangement appear normal. It shows biliary stasis and collections of cells in the portal areas.

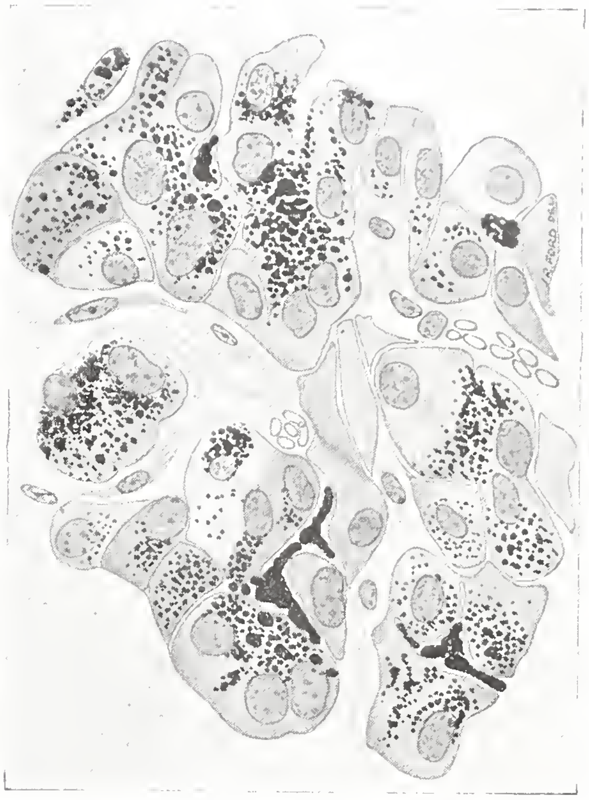

FIG. 2.—Section from the same liver as Fig. 1. (High power.)

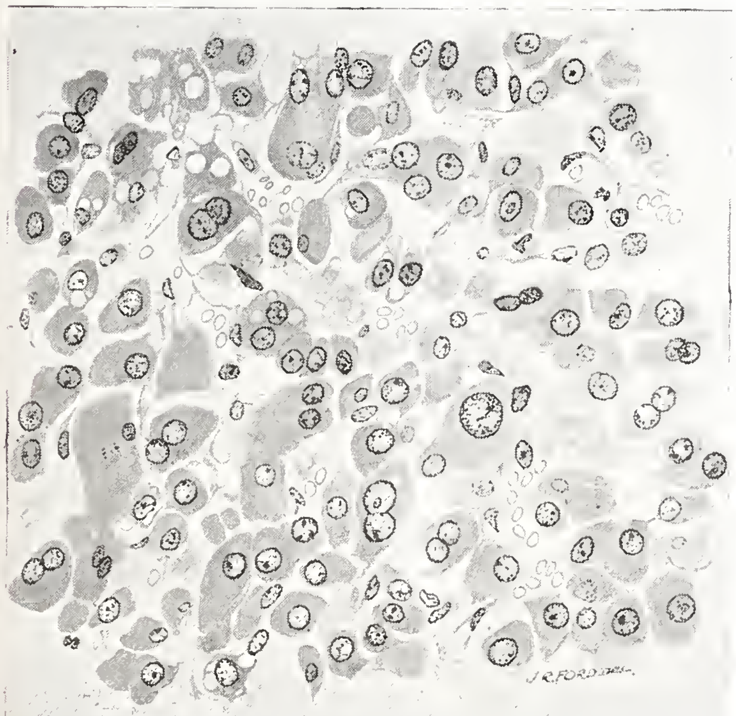

FIG. 3.—Spirochaetes in the blood of a guinea-pig experimentally infected.

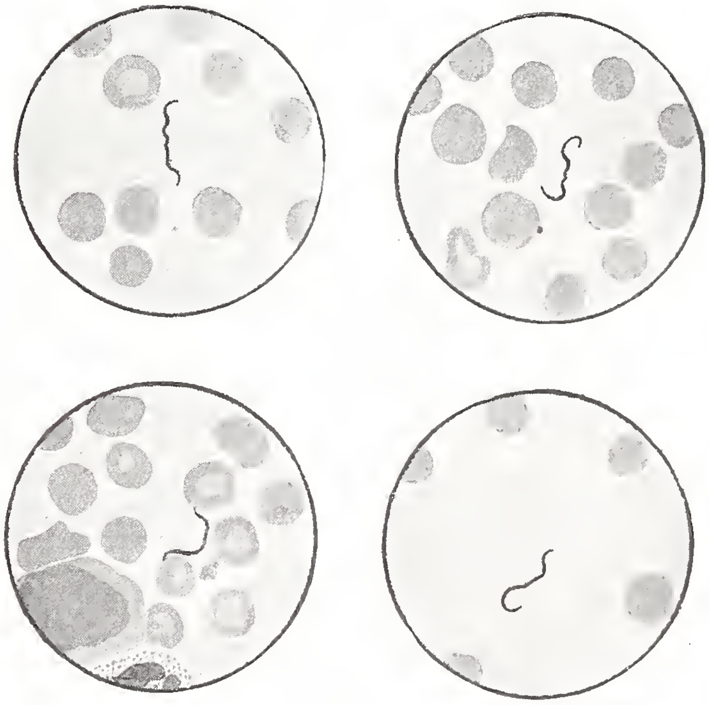

FIG. 4.—Section of liver from a case of spirochaetal jaundice. Showing dissociation of cells.

might be confused with spirochaetosis icterohaemorrhagica before the development of jaundice, or with that type of the infection in which jaundice is altogether absent.

Clinical Pathology.

Apart from the finding of the spirochaete in the blood stream and the injection of infected blood into the guinea-pig, which are discussed below, examination of the peripheral blood reveals the following departures from the normal state. In all severe cases there is a slight anaemia. the average red cell count being 4 to 4½ million per c.mm., and the haemoglobin percentage is reduced to 80 to 90 per cent. Some cases become very anaemic, and in one case the red cells numbered 2½ million per c.mm. There is invariably a leucocytosis, amounting in some cases to 25,000 per c.mm. Differential counts show a relative increase of the polymorphonuclear leucocytes to 75 to 80 per cent.

The fragility of the red cells has been frequently tested and is found to be either normal or slightly diminished. No abnormal red cells have ever been detected. It is certain, therefore, that the jaundice is not of haemolytic origin.

As there was evidence that the jaundice was due to some obstruction in the biliary passages, and as the *post-mortem* examination on two cases suggested an inflammation of the duodenum, attempts were made on many occasions to siphon off the duodenal contents by means of an Einhorn tube. Though no spirochaete was ever detected in the fluid so obtained, the finding of catarrhal cells in large numbers suggested the presence of a duodenitis in some cases.

Many of our cases in whom the spirochaete was discovered were investigated thoroughly from the point of view of the enteric group. The examinations were always negative, both from blood culture and from a study of the agglutination curve.

Morbid Anatomy.

The opportunities of *post-mortem* examination have been few, and the following account is based on four cases in our own series and the accounts of four *post-mortem* examinations described by Captain Stokes and others. Six patients died on the ninth, twelfth, thirteenth, fourteenth, seventeenth, and twenty-eighth days respectively, and one patient, in whom the date of onset was doubtful, died on the fourth day after admission to a casualty clearing station.

All the bodies were deeply jaundiced with the exception of the case who had died on the twenty-eighth day.

The Stomach and Intestines.—As the jaundice in these cases appeared to be of the obstructive type, special attention was given to the condition of the duodenum, and in three of our cases the appearances pointed to a duodenitis. The mucous membrane was of a bluish-red colour, and the Brunner's glands appeared through the mucous membrane as small yellow, opaque areas, from the size of a pinhead to that of a split pea. The whole of the mucous membrane had a swollen, watery appearance. In these cases the area round the ampulla of Vater seemed to be particularly affected. Other cases did not show this same duodenal condition, and microscopic examination did not give any evidence of recent or old inflammation.

In one case there was a considerable submucous haemorrhage in the stomach, and in another a polypoid condition of the mucous membrane at the pyloric end. Scattered subperitoneal haemorrhages were commonly found over the small intestine. No noteworthy lesions were discovered in the mucous membrane of the small or large intestine in any other case. The omental glands were usually enlarged.

The Liver and Bile Passages.—Particular attention has been given to the naked eye and microscopic appearances of the larger bile passages. These were normal in appearance and showed no evidence of inflammation except in the last half-inch of the common duct lying within the duodenal wall. This was swollen and of bluish colour in resemblance to the duodenal mucous membrane. In one instance a probe passed along the common duct into the duodenum dislodged a formed plug which was impacted in the ampulla. A film made from this plug showed numerous epithelial cell nuclei embedded in a matrix of mucin.

In all cases the liver to the naked eye was normal in pattern and texture, though sometimes altered in colour, due to bile stasis. Microscopically its appearances varied. In one group the cells of the lobules were natural in arrangement and appearance, and, apart from evidence of biliary stasis, the only abnormal feature was the presence of collections of cells in the portal areas, such as occur in other diseases. (Figs. 1 and 2.) In another group the liver cells were dissociated (Fig. 4), and many were markedly enlarged and contained well-stained nuclei. Collections of such hypertrophied cells, with clear pale protoplasm, appeared, especially just beneath the capsule. Many liver cells contained two nuclei, and mitoses were numerous. Staining with Sudan III showed a very little fat, in the form of fine droplets, which were partly within the endothelium (Kupffer's cells).

The sum of these changes suggests the effect of damage which has been insufficient to cause extensive necrosis, but has acted as a stimulant to cell growth. In addition, the portal areas show collections of small mononuclear cells and polymorphs, and towards the centres of the lobules both intracellular and extracellular granules and masses of pigment were found. These microscopic changes resemble those described by Beitzke and Herxheimer.

In one case there were only slight changes—namely, variations in the sizes of the nuclei, a few mitoses, vacuolation of the central cells of the lobules, and in one place a hepatic venule was filled with a mass of dissociated liver cells mingled with red blood corpuscles. A film made from a scraping of this liver showed one characteristic spirochaete. Stokes in two cases describes an exudation of cells into the interstitial tissue surrounding the smaller bile ducts. He detected leucocytes lying "between the liver columns, and usually between the vessels."

The Kidneys.—Stokes described the lesions in the kidneys under three headings: (1) Swelling and granular degeneration of the tubular epithelium, particularly of the proximal convoluted tubules and the ascending loops of Henle; (2) an exudation of polymorphonuclear leucocytes between the tubules and, more rarely, within them; (3) haemorrhages into the lumen of the tubules in poorly defined patches.

The glomeruli showed no changes in particular.

The Spleen.—In no case was there any enlargement or any sign of involvement of this organ. This harmonizes with the clinical observation that the spleen is not usually enlarged in this disease.

The pancreas was firm and to naked eye and microscopic examination was perfectly normal.

The Lungs.—In all our cases there were haemorrhages in the lungs, in two cases reaching the size and consistence which is met with in cases of mitral stenosis. There was nothing noteworthy in any of the other organs of the body. Stokes showed the presence of the spirochaete in the kidney in one of his cases. In no other morbid human tissue has he or have we been able to detect it.

EXPERIMENTAL PATHOLOGY.

I. Historical.

It is to the Japanese workers Inada and Ido that we owe the discovery of the *Spirochaeta icterohaemorrhagiae*. In November, 1914, they announced the discovery of a spirochaete in the liver of a guinea-pig which had developed jaundice and died as the result of the inoculation of blood from a case of jaundice, epidemics of which they were investigating in conjunction with Hoki, Kaneko, Ito, and Matsuzaki. This finding they were able to repeat, the spirochaete being found in the liver and blood of the infected animals in large numbers. The infection was shown to be transmissible from animal to animal. Later these Japanese workers were able to demonstrate the specificity of this spirochaete, the finding of it in the patient's blood in six cases, in the tissues in two fatal cases, and the discovery of protective substances against it in the serum of patients recovering from the disease putting this question beyond doubt. Similar findings were announced by the German workers Hübener and Reiter, Uhlenhuth and Fromme, and Bietzke, obtained by them during investigations of the jaundice epidemic amongst their troops. No mention, however, is made by them of the Japanese work. The researches of Stokes, Ryle and Tytler, Dawson and Hume, on the British front, and later those of Martin and Pettit, Garnier and Reilly, Costa and Troisier in the French army, have shown that a similar type of jaundice is epidemic on the Western front, findings corresponding with those of the Japanese having been obtained.

II. Experimental Inoculation.

Attempts to reproduce this condition in animals have shown that the guinea-pig is the animal of choice, the monkey and rabbit being more or less immune, whilst the mouse and white rat occupy an intermediate position. The guinea pig can be infected by the intraperitoneal injection of the patient's blood or urine. In the case of blood, success can only be looked for with any degree of certainty if it is taken early in the disease—fourth or fifth day—and though the blood may still be infective as late as the seventh, eighth, or ninth day, later than that period the results are almost always negative. The intraperitoneal injection of 3 to 5 c.cm. of blood gives the most satisfactory results. As regards the infectivity of the urine for the guinea-pig, some difference of opinion seems to exist. The Japanese authors claim that the patient's urine is infectious for the animal early in the disease, and as in the case of the blood, this diminishes as the disease progresses. They have, however, had positive results as late as the twenty-first day. On the other hand, Garnier and Reilly claim that it is only from the tenth to eleventh day onwards that the urine is capable of infecting the guinea-pig, that is to say, from the time the spirochaete can first be demonstrated in the urine microscopically, and that earlier in the disease the results of their experiments have been consistently negative. Stokes's attempts in this direction were on no single occasion attended with success, despite the fact that the centrifugalized deposit from large quantities of urine was employed and the attempts were made at various periods of the disease. Our experiments, though few in number, were negative.

The Disease in the Guinea-pig.

The disease in the guinea-pig is characterized by jaundice, haemorrhages, conjunctival congestion, albuminuria, and pyrexia. It is nearly always fatal. The incubation period in the animals injected with the patient's blood is somewhat variable—from six to thirteen days. Stokes quotes a case in which it would appear to have been as long as eighty-six days. After several passages of a strain the incubation period is gradually reduced until it reaches a point where it remains more or less constant, between four and five days. The mode of inoculation naturally affects the incubation period, it being longer when the infectious material is injected subcutaneously. The disease is ushered in by a sharp rise in temperature, the animal is quiet and refuses to eat. A temperature of 103° F. is the rule, though it may rise to as much as 106° F. Jaundice appears when the temperature has reached its maximum, the animal becomes more acutely ill, and usually twenty-four hours after its appearance we have a fall of temperature to subnormal, collapse, and death. Spirochaetes appear in the blood with the onset of pyrexia (Fig. 3), and can be demonstrated in the urine *ante mortem*. Conjunctival congestion is usually present, skin haemorrhages and haematuria are not infrequent.

Blood Changes in the Guinea-pig.

Anaemia towards the end of the disease in the animal, according to Stokes, is marked and accompanied by a fall in the leucocyte count. Our observations, though few in number, do not bear out this statement, a moderate degree of anaemia only, and a polymorphonuclear leucocytosis with a total white count of from 18,000 to 25,000 being noticed. These findings bear out those of Dawson and Hume in this disease in man, a moderate polymorphonuclear leucocytosis being a constant feature. Apart from a certain degree of polychromasia, we have not found any changes on the part of the red cells.

Pathological Changes in the Guinea-pig.

The findings in guinea-pigs which have died of the disease, or which have been killed after the appearance of the jaundice, are characteristic. We have jaundice of varying intensity of the skin and all internal surfaces. As a rule the jaundice is marked, but occasionally, as in man, one meets with cases which show little or none. This is, however, a rare occurrence. Fine petechial haemorrhages are seen in the skin, subperitoneally and in the muscles, particularly those of the thighs and abdominal walls. The loose areolar tissue of the groins, axillae, and cervical regions shows haemorrhages of varying size, and the lymph glands in these regions are enlarged and frequently haemorrhagic. The post-peritoneal tissue also shows numerous haemorrhages, particularly in the region of the kidney, that organ being frequently surrounded by a layer of free blood. The small bowel is usually congested, and in the larger percentage of cases shows numerous subserous haemorrhages usually elliptical in shape. On opening the gut it is occasionally noticed that the duodenum, particularly in its upper portions, is more congested and the mucosa more swollen than the rest of the small intestine. This same fact was drawn attention to by Dawson and Hume. The large bowel may show little or nothing, or it may be the site of areas of haemorrhage, which vary from clusters of pin-point haemorrhages to areas 0.5 to 1 cm. in diameter, which suggest the commencement of ulcer formation.

The kidneys are acutely congested and show minute haemorrhages, subcapsular and throughout the cortex. The suprarenals are usually the site of large haemorrhages, as is the case in any acute toxaemia in the guinea-pig. The liver, as a rule, shows no macroscopic changes. The spleen is congested, friable, and in the majority of our cases showed distinct enlargement, though Stokes describes it as "not obviously enlarged." The epididymis and testicle may also show haemorrhages. The lungs show the most characteristic changes in the shape of multiple clear-cut haemorrhages, varying in size from that of a pinhead to a threepenny-piece, and giving rise to that appearance which the Japanese authors very happily describe as being like "the wings of a mottled butterfly." As pointed out by Stokes, the larger haemorrhages are usually confined to the lower lobes and may be arranged symmetrically along the lateral margins of them. He also draws attention to the fact that these haemorrhages in the lungs and intestine are of early appearance, having been noticed by him in animals killed twenty-four hours after injection. The heart, as a rule, shows nothing, but, as in the case of other viscera, it is sometimes the site of small haemorrhages.

Pathological Histology.

Liver.—The changes seen in the liver may vary from cloudy swelling to acute parenchymatous degeneration, small prescribed areas of cell necrosis sometimes being found on section. According to the Japanese, the biliary ducts show no congestion, but Stokes describes an inflammatory process about the smaller bile ducts with a leucocytic infiltration of the affected areas—a pericholangitis—and to this he is inclined to attribute the jaundice.

Kidney.—This organ shows those changes characteristic of an acute parenchymatous nephritis. The tubular epithelium shows degenerative changes, in many cases both marked and extensive. There is a leucocytic infiltration of varying degree around the affected tubules, and not infrequently the affected tubules in places are packed with leucocytes. Haemorrhages occur throughout the cortex and many tubules are seen to be filled with red cells. These degenerative processes fall chiefly on the proximal convoluted tubules and the thicker portion of the loop of Henle, the glomeruli as a rule not being markedly affected.

Suprarenals.—Almost invariably these organs are haemorrhagic, and in acute cases they show haemorrhages involving practically the whole of their structure. The haemorrhages apparently originate in the medulla.

Lymphoid Tissue.—The spleen, lymph nodes, and Peyer's patches all show congestion and some endothelial proliferation. The spleen shows evidence of increased blood destruction, the sinuses being packed with macrophages containing red cells; free pigment and leucocytes are also present. The lymph glands occasionally show haemorrhage, and the Peyer's patches are usually surrounded by haemorrhage in the form of a thin layer of free blood, and also show extravasated blood throughout the lymphoid tissue.

Lungs.—The haemorrhages in the lungs are seen to be pyramidal in shape, with their base lying against the pleura. They are frequently limited by the boundaries of the lobule. The vessels leading to these areas of haemorrhage are frequently seen to be packed with leucocytes, and Stokes describes cases in which thrombi have been noticed in these vessels, though he does not consider the evidence sufficient to attribute the haemorrhages to these thrombi.

Distribution of the Spirochaete in the Guinea-pig.—The spirochaete lives and multiplies in the blood stream and in various organs. It is usually extracellular, and when present in the tissues it is found in the interstitial tissue, or more rarely in the endothelium or in the phagocytic cells. In the guinea-pig, unlike the case in man, it is found with ease in the blood of the jaundiced animal, especially in the case of a strain which has gone through several animal passages and kills the animal rapidly. The liver contains the spirochaete in great numbers, and it is sufficient to make a smear from a portion of this organ to have a preparation showing a dozen or more spirochaetes per oil-immersion field. In stained sections the spirochaetes are seen to be numerous and extracellular for the most part, forming when very numerous a sort of garland round the individual cells. After the liver, the kidneys and suprarenals contain the largest number of spirochaetes. In the kidney they occur in the interstitial tissue between the tubules and also in the walls and lumen of the tubules themselves. Unlike the case in the liver, their distribution in the kidney is by no means general but is limited to areas, where, however, they are numerous. Although comparatively numerous in the blood stream, the spleen and bone marrow contain few. The lymphoid tissue (splenic follicles and lymph glands) also shows but few spirochaetes, and in the lungs, heart muscle, striated muscle and arterial walls they are rare. They are numerous in the urine from the commencement of the jaundice. Though the foregoing description of the distribution of the spirochaete in the diseased guinea-pig is true for the majority of cases, one occasionally meets with animals in which the spirochaete is only found with difficulty. It may be stated as a general rule, however, that those animals showing the most marked lesions contain the most spirochaetes.

Mode of Excretion.—In the guinea-pig the spirochaete is excreted in the bile, faeces, and urine, though it is only in the latter that it is with any ease demonstrated microscopically. The Japanese workers have shown, however, that all three are infective for the guinea-pig, their experiments with the bile of infected animals giving a greater percentage of successful results than those with the faeces and urine, despite the fact that on no single occasion were they able to demonstrate the spirochaete microscopically in it.

Technique of Transfer.—The disease can be transmitted from animal to animal most surely by employing the heart blood or the emulsion of liver of a diseased animal. Inada states that he found the former, injected in quantities of 2 c.cm., the most satisfactory, but our findings and those of Stokes would point to the emulsion of liver being the more certain of the two. In the case of the heart blood all that is necessary is to collect the blood with the usual precautions as regards sterility and to inject it intraperitoneally into the fresh guinea-pig. If the liver emulsion is to be employed, the liver is removed as rapidly as possible after opening the animal, using the greatest possible care to avoid contamination, and is placed in a sterile vessel, where it is roughly ground up with a small quantity of normal saline. The resulting emulsion is then rapidly centrifuged to throw down the lumps of liver tissue, which would block the needle, and the fluid so obtained injected intraperitoneally or subcutaneously. The employment of a large-bored needle will be found advisable, and in all cases where a possible contamination is suspected, such as invasion of the liver tissue by bacteria *post mortem* should the animal have been dead some little time, the subcutaneous route for inoculation is the one of choice. In a like manner an emulsion of any other organ containing the spirochaete, such as the kidney or suprarenal, could be employed. Besides the subcutaneous and intraperitoneal methods of inoculation which are employed as a rule owing to their simplicity, the guinea-pig can be infected by way of the mouth, feeding the animal on food soaked in liver emulsion, by applying the virus to one of the available mucous surfaces, and by smearing it on to the shaved skin.

III. MORPHOLOGY.

Microscopical Appearance.

This organism is fairly pleomorphic, and varies in length from $4\,\mu$ to $25\,\mu$, with an average length of 8 to $9\,\mu$. Its thickness varies with the staining method employed, but the Japanese workers are of the opinion that it is probably about $0.25\,\mu$. The ends are sharp and pointed, and are in most cases hooked, not uncommonly both ends being bent to the same side in the form of a letter C, or one end is bent in an opposite direction to the other, giving the parasite an S-shaped form. The spirochaete, unlike *Treponema pallidum*, shows irregular undulations usually composed of 2 to 3 large or 4 to 5 smaller waves. This is not always the case, Martin and Pettit pointing out that occasionally one comes across forms in which the waves are more numerous and more regular, the parasite approaching more the form of *T. pallidum*. In the blood the spirochaete conforms to the typical form, except in those severe infections where it is very numerous, and then one meets with parasites bent in the form of a ring or twined one about another. On the other hand, the forms met with in the liver vary much in shape and length. One sees straight forms, others bent at one end only, giving the parasite the appearance of a note of interrogation, and again others showing round or oblong granules, 3 to 4 in number, staining a deep purple with Giemsa. Still larger granules may sometimes be observed projecting from the body of the spirochaete—the so-called "lateral bud" of the spirochaete already described in the case of other varieties—the significance of which is not apparent. Degenerative forms are also met with which are thick, devoid of waves, and blunt at the ends. Flagella were not described by the Japanese, but Martin and Pettit and Vaudremer in a recent publication describe flagella, which they have been able to demonstrate by Löffler's and Van Ermengem's staining methods. These are terminally placed, and vary in number and length. Further, they have been able to show that the flagellum ends in a small circular knob, the significance of which has yet to be elucidated.

Staining Methods.—Unstained in a hanging drop preparation, the spirochaete is invisible with the ordinary microscope except when very numerous, and even then its presence is detected only with the greatest difficulty.

Dark-ground Illumination.—By this means the spirochaete can be readily studied. It is not nearly so refractile as *T. pallidum*, and its movements are much more sluggish. As a rule it remains motionless, or is simply carried across the field by the currents set up between the slide and cover slip. It is, however, capable of lashing movements of the extremities, the centre portion of the parasite remaining rigid, or it may show twisting worm-like movements.

Dried Smears.—Smears of blood, tissues, or urine sediment can be readily stained by Geimsa, Leishman, Tribondean, or a rapid silver impregnation method such as Fontana. With Giemsa, after a preliminary fixation with methyl alcohol, absolute alcohol, or osmic acid, the preparation is stained for two hours with a mixture of 20 drops of stain in 10 c.cm. of water. Generally speaking, when the leucocytic granules are deeply stained, the spirochaete will be found to be stained. With Leishman, after the preliminary fixation for one minute with undiluted stain, the diluted stain is allowed to act for thirty minutes. This gives quite satisfactory results, and though not deeply stained the spirochaete is readily visible. Coloured by these methods, the spirochaete has a pinkish-purple tint. Burri's Indian ink method and similar processes give us a rapid and satisfactory means of demonstrating the spirochaete in smear preparations, but perhaps the most satisfactory of all is that of Fontana, which consists of staining the preparation with an ammoniated silver nitrate solution after a preliminary mordancing with 5 per cent. aqueous solution of tannic acid.

Staining of Sections.—The most satisfactory staining process for sections will be found to be the older Levaditi method.

Staining of Flagella.—For this purpose the methods of Löffler and Van Ermengem both give satisfactory results. The following are the directions given by Martin, Pettit, and Vaudremer:

(*a*) *Löffler.* Fix in ether-alcohol. Cover the preparation with Löffler's fuchsia ink and heat gently, stopping the heating as soon as the preparation commences to steam. Wash in distilled water, and then three times with absolute alcohol. Stain with alkaline aniline gentian violet, warming gently. Wash in distilled water and dry.

(*b*) *Van Ermengem.* Follow the classical technique, but in place of Ziehl's carbol fuchsin stain the preparation with alkaline aniline gentian violet, diluted so as to obtain a background not too deeply stained.

IV. CULTIVATION EXPERIMENTS.

The first successful attempts to cultivate the spirochaete were those of the Japanese Ito and Matsuzaki.

Starting from the infected guinea-pig, the spirochaete was obtained in pure culture by the method of Noguchi, guinea-pig kidney replacing that of the rabbit usually employed. The cultures were covered by a layer of liquid paraffin. The best results were obtained at a temperature of 22° to 25° C. They noticed that growth commenced in from three to seven days, or rarely after a delay of as much as two weeks, that the first generation lived for three to six weeks, and that the lives of the succeeding generations were rather shorter. Since then they have succeeded in growing the organism on various different media, solid and liquid—blood agar and gelatin, human serum, diluted ox serum and ascitic fluid. Martin and Pettit in repeating this work have been unable to obtain cultures on solid media, but, however, have been successful with various liquid media. The most satisfactory they found to be diluted rabbit serum (1 in 5 of normal saline), and diluted ox serum (1 in 9 of normal saline), without the addition of pieces of tissue, but merely covered with a layer of liquid paraffin. The organism grows well at a temperature of between 25° and 32° C., refusing to grow at 37° C. or only after acclimatization. The cultures are inoculated with the heart blood or emulsion of liver of a jaundiced guinea-pig which has been preferably killed and not allowed to die of the disease. The cultures remain clear, any cloudiness or turbidity being an indication of contamination and of failure because the spirochaete refuses to grow, or only shows feeble growth in the presence of other organisms. The cultures are without odour and ascitic fluid remains uncoagulated. In culture the spirochaete is evenly distributed throughout the media, and is shorter and more active than when seen in the tissues. Occasionally one sees several spirochaetes intertwined together in the form of a rosette, and here and there individuals of exceptional length. As the culture becomes older the organism becomes less active, and degeneration forms make their appearance. Subcultivation should be practised when growth is at its height, that is, when spirochaetes are numerous and active. The cultures are capable of reproducing the disease in the guinea-pig, and their virulence is maintained up to the twenty-second day.

V. Mode of Spread of the Disease.

In their first communication the Japanese authors expressed the opinion that infection occurred through the skin or by the mouth. As was shown by them, the spirochaete is excreted chiefly by way of the urine, which provides a ready means for the dissemination of the virus. They had noticed, also, that epidemics of jaundice occurring in mines were confined to "wet" mines, and that if in a mine the cases came from one particular portion, that portion of the mine was invariably a flooded one. The animal experiments performed by them showed that the guinea-pig could be readily infected by way of the mouth, or by simply applying the infectious material to the shaved skin, abraded or intact—five minutes' contact being sufficient for infection to have taken place. Knowing these facts it seemed probable that in these epidemics, in the mines at any rate, the water having been contaminated by urine the spirochaete gained entrance to its new host via the skin or by the mouth. This was further borne out by the fact that when the flooded portions of the mine were pumped dry the incidence greatly decreased. In the communication of Stokes, Ryle and Tytler attention is drawn to the fact that the cases of jaundice occurring in this sector of the line came almost exclusively from one or two portions of the front line trench, and that as soon as the units were moved out of these particular trenches they ceased to have cases of jaundice, and in a similar manner fresh units moving into them, who had had no cases up to that time, almost immediately commenced to develop them. These portions of trench when compared with the rest of the line were distinguished from the remainder by always being in a very wet condition, it being impossible to drain them properly. In their first paper the Japanese discussed the possibility of biting insects, such as the flea or mosquito, playing a part in the spread of the disease from man to man, but concluded that the smallness of the numbers of the spirochaetes in the peripheral circulation made it very doubtful. Stokes also undertook experiments with a view to finding out if the body louse, so common amongst the troops, could be incriminated. When one considers however how general the distribution of the louse is, and how localized the areas from which cases of jaundice come, this does not seem probable. His experiments proved negative. In a recent communication the Japanese state that they have been able to show the presence of the spirochaete in 38 per cent. of the field rats coming from areas in which jaundice was epidemic, and they suggest that the infection may be conveyed by the rats' urine directly or indirectly. Stokes has been able to confirm this finding, six out of fifteen rats caught in these areas in which jaundice was endemic having been shown to contain the spirochaete in the kidney capable of producing the disease in the guinea-pig. It would appear, therefore, that the rat acts as a reservoir for the infective agent, spreading the disease by means of its urine directly or indirectly, and that infection is further spread by the patient's urine and faeces.

VI. Immunity.

The Japanese in their first paper pointed out that the blood of convalescent patients contained protective substances capable of neutralizing the virus *in vitro*, and of protecting the guinea-pig against infection. This substance is first demonstrable in the blood serum after the tenth day of illness, but, as a rule, is not found before the fifteenth to the twentieth day. This immune substance persists in the blood for a long time, the Japanese authors quoting two cases in which it was detected at the end of five and a half years. It is specific, and is not present in the serum of healthy persons, nor in the serum from cases of jaundice of other origin.

The immune substances can be demonstrated by the reaction of Pfeiffer, the results of the experiment being confirmed by the subsequent condition of the guinea-pigs, the control animal developing jaundice and dying, while the other which received the virus and the patient's serum remains unaffected. They also showed that this substance was endowed with curative properties, the diseased guinea-pig being cured by an injection of the patient's serum if it was administered before the onset of jaundice. These facts have been confirmed by the French and by Stokes, the latter having shown that even after the appearance of jaundice the guinea pig can be cured, provided the serum is injected before the collapsed stage is reached. In view of these facts, the Japanese have prepared an antiserum by immunizing a horse, and report encouraging results from the employment of this serum therapeutically. The French also are preparing an antiserum, but so far have published no results of its application in the disease.

Attempts have also been made to demonstrate immune bodies in the patient's serum by means of the reaction of the fixation of complement. As antigen an emulsion of liver rich in spirochaetes was employed. Stokes reports negative results with this reaction, and, while Martin and Pettit state that it was positive in the five cases in which it was tried by them, they at the same time admit that a strongly syphilitic serum gave a positive result also.

The serum of the patient, according to Garnier and Reilly, does not agglutinate the spirochaetes, whereas the Pasteur Institute serum agglutinates them readily, the spirochaetes losing their mobility and running together into clumps.

VII. Bacteriological Diagnosis.

Direct Examination of the Blood.

Owing to the shortness of the period during which the organism is to be found in the circulation and the smallness of its numbers when present therein, the direct examination of blood smears for the spirochaete is of little value as a practical method of diagnosis. However, in the early stages of disease (up to the seventh day) it is sometimes possible to demonstrate the spirochaete in this manner, and, seeing that it requires little time or trouble, it is worthy of trial. The blood may be examined by means of the ultra-microscope; blood smears may be stained by Giemsa, Leishman, and Fontana, or preparations made with Burri's Indian ink method.

Animal Inoculation.

The reproduction of the disease in the guinea-pig by the injection of the patient's blood or urine is undoubtedly the most satisfactory and convincing diagnostic test we at present possess, but unfortunately, owing to the fact that it is only in the early stages of the disease that the blood is infective and that the infectivity of the urine is a very variable quantity, this method of diagnosis as a practical measure has its limitations. In the early days of the disease, up to the seventh or even ninth day, one, or preferably two, guinea-pigs should be inoculated intraperitoneally with 3 to 5 c.cm. of the patient's blood. Injection of larger quantities of blood is of itself sufficient frequently to kill the guinea-pig. In a positive case, after an incubation period of from six to twelve days, the animal develops the disease and dies, showing the characteristic changes already described. Similarly, in the early days of the disease the injection of the urine into the guinea-pig should be done, and even after the blood has ceased to be infective and the case is well advanced, it is perhaps worthy of trial, because, as shown by Garnier and Reilly, positive results may be obtained as late as the twenty-eighth day. These workers inject the centrifugalized deposit from 40 to 60 c.cm. (occasionally as much as 150 to 250 c.cm.) of recently passed urine, suspended in 5 c.cm. normal saline. Naturally all precautions as regards sterility must be observed in the collection and centrifugalization of the urine.

Examination of the Urine for Spirochaetes.

As pointed out by the Japanese, the spirochaete is eliminated chiefly by way of the kidney, and from the ninth day onwards can be demonstrated microscopically in the urine. At first it appears in the urine in small numbers only, the number gradually increasing to a maximum reached about the thirteenth to fifteenth day of disease, to diminish again and finally disappear from the urine about the fifth or beginning of the sixth week of illness. Should, therefore, a case of jaundice present itself too late in the disease to make the injection of the guinea-pig with the blood of no use, and should the injection of a guinea-pig with the urine have proved negative, the demonstration of the spirochaete in the urine gives us valuable information as to the cause of the jaundice. The procedure is simple and is as follows: The urine is collected in a sterile vessel and 50 c.cm. or so centrifuged. The deposit so obtained is washed with distilled sterile water and recentrifuged and smears made with the final deposit. Preparations can be made by the Indian ink method, Harrison's collargol method, or with a 2 per cent. aqueous solution of Congo red, treating the smear so obtained with 1 per cent. HCl in alcohol, as recommended by Benians. These methods have the advantages of rapidity and simplicity, but in our opinion the best is the staining of dried smears by the method of Fontana. Should, therefore, the urine of a case of jaundice, examined in this manner towards the end of the second or beginning of the third week, show the presence of numerous spirochaetes having the morphological characters of the *Spirochaeta icterohaemorrhagiae* already described, and should the case have been proved negative for the enteric group by blood culture, examination of stools and urine for bacilli or by agglutination, there is little doubt that the case in question is one of spirochaetosis. It must be borne in mind, however, that it is not sufficient to examine the urine on one occasion only, but several examinations at intervals of two to three days may be necessary before the spirochaete is found. Even then, as pointed out by Stokes, we may fail to find the spirochaete because it is to be expected that in mild cases the numbers excreted will be small, and the period during which they are to be found in the urine transient. It cannot be claimed, however, that this method of diagnosis has the same value as the production of jaundice in the guinea-pig as there are certain obvious sources of error. These are the limitation of the microscope when used alone to determine the species of micro-organism with which one is dealing and the presence of other bodies in the preparation resembling spirochaetes liable to mislead an inexperienced observer. The latter error should not be made by a skilled worker, and though the examination by us of control urines from cases of scarlet fever, measles, lobar pneumonia, typhoid and paratyphoid fever have occasionally revealed the presence of spirochaetes, this has been of rare occurrence, and in no case did these spirochaetes or spirilla bear any morphological resemblance to the *Spirochaeta icterohaemorrhagiae*. We have, therefore, concluded that in a case of jaundice the clinical symptoms of which point to spirochaetosis, which has been proved negative to the enteric group, and in the urine of which spirochaetes with the morphology of *Spirochaeta icterohaemorrhagiae* have been found, one is in possession of a chain of evidence warranting the diagnosis of spirochaetal jaundice.

Immunity Reactions.

1. *Reaction of Neutralization.*—This reaction, already referred to under the heading of immunity, can be made use of in diagnosis. It suffices to mix a toxic dose of virus (liver emulsion) with 1 to 2 c.cm. of the serum from the case in question and to inject it into a guinea-pig intraperitoneally. The control animal receives the virus alone. If the case is one of spirochaetosis, the guinea-pig remains unaffected, the control animal dying with the characteristic *post-mortem* changes; on the other hand, if the case were not one of spirochaetosis, both animals would develop jaundice.

2. *Fixation of Complement.*—It would not appear that, in our present state of knowledge, this reaction would be of much service in diagnosis. Martin and Pettit report positive results, however, in the five cases in which it was tried by them, but the value of these results was somewhat detracted from by the fact that a strongly syphilitic serum gave a positive result as well with their antigen.

CONCLUSION.

It would seem to be proved that there is in the armies in France a type of infective jaundice which is the same in clinical and pathological features as that described by the Japanese workers, and that this disease is caused by the *Spirochaeta icterohaemorrhagiae*. And there is also undoubted proof that this same spirochaete may cause a similar train of symptoms without the appearance of jaundice.

A complete bibliography is appended, and to the authors of the various publications we acknowledge our debt.

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CHAPTER XIII.

THE PART PLAYED BY BRITISH MEDICAL WOMEN IN THE WAR.

BY

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In the days of peace medical women took their share in all phases of professional life in Great Britain and Ireland so that they needed no separate history. But in war the spheres of work open to them are limited by military considerations, and it has seemed proper, therefore, to attempt some account of the manner in which they have come forward to render professional services to the wounded and sick. They have not shrunk from personal risk and hardship, and at the same time have done their part in bringing modern scientific methods to bear on the novel clinical problems with which the special circumstances of this war have confronted military medicine, and have not only individually shown untiring energy in emergencies, but also an admirable capacity of a combination and organization in face of unforeseen difficulties. The account does not profess to be complete, it does not make mention of much good work done by individuals, and contains little reference to the many medical women who have laboured with medical men at home for the good of the civil population; but such as it is it has an interest of its own as a sketch of the work done by British medical women in the first war in which they have been numerous enough to count.

In the early days of the war British medical women volunteered their services in aid of the wounded of their own country, but finding that the British Red Cross and the War Office were at that time amply supplied, they turned their attention to the needs of the Allies, whose countries were already invaded by the enemy. Units composed partly or entirely of women were accepted for service under the Belgian, French, and Serbian Red Cross.

The Women's Imperial Service League was the first to send a hospital to Belgium, and though, owing to the rapid and unfortunate march of events there, its career was short, it rendered very material service during the siege of Antwerp. Miss Stoney, M.B., B.S.Lond., with a staff of six women doctors, was in charge of the hospital, which was full of seriously wounded cases when the bombardment on October 8th took place. The hospital was eighteen hours under shell fire before the patients (Belgians and some British) could be placed in comparative safety. During this time no member of the unit was injured, although the ground was littered with shell and the houses round were burning. The unit crossed the Scheldt by the bridge of boats on London motor buses to join the retreating British marines twenty minutes before the boats were blown up by the retreating Belgians.

In November, 1914, the unit was formed again, and a hospital of 70 beds was established at Cherbourg under the French Red Cross in an ancient chateau. Two days after their arrival seriously wounded French, Belgians, and Senegalese came in from Dunkirk by boat. Most of the cases had badly comminuted fractures, and, as they did not arrive until four to eight days after being wounded, a considerable number of amputations had to be performed for gangrene, advanced sepsis, septicaemia, and secondary haemorrhage.

It was not until the spring of 1915 that medical women undertook the full charge of British wounded in England, although in October, 1914, Dr. Louisa Garrett Anderson established, under the French Red Cross, a small hospital in Paris which received some British wounded.

In consequence of a rearrangement of the transport of the wounded the hospital at Cherbourg was closed early in 1915. Dr. Florence Stoney was appointed radiologist to the Fulham Military Hospital in April of that year, with a ward for the treatment of cases of disordered action of the heart, shell shock, and Graves's disease. By January, 1916, this department had already examined 4,351 cases, and had taken 5,530 skiagrams, in addition to giving *x* ray, high frequency treatment, and vibratory massage. The special study of the action of *x* rays in hyperthyroidism led Dr. Stoney to point out the close connexion between hyperactivity of the thyroid gland and the tachycardia and breathlessness seen in cases of "irritable heart" and "soldier's heart." By *x*-ray treatment the thyroid gland can be reduced in size. As it grows smaller the symptoms disappear. The thyroid in exophthalmic goitre is much more easily affected by *x* rays than the thyroid of a quiescent bronchocele, as the glandular cells are in a very active condition. Conditions similar to Graves's disease are produced by war strain. Dr. Stoney believes that *x* rays are a specific for exophthalmic goitre, though the heart condition is incurable, the muscle remaining weak, so that the organ can be more easily overstrained than a healthy heart. Symptoms of hyperthyroidism are often of late onset in ordinary bronchocele, when microscopically areas of altered tissue similar to that occurring in exophthalmic goitre are found. Thus Graves's disease may be primary (most of the cases in the war come under this group), or grafted on to a pre-existing bronchocele. Dr. Stoney places special stress on the following abnormal symptoms needing treatment: (1) Fine tremor, (2) excessive perspiration, (3) great nervousness and twitchings, and (4) a pulse-rate habitually over 90. A common combination is tremors, breathlessness, tachycardia, weakness, and sweating, nervous twitchings, and obliteration of wrinkles on the forehead. Though *x*-ray treatment does not deal with the primary cause of the disease it relieves the patient by lessening the thyroid gland. Its chief disadvantage is that several sittings, spread over a couple of months or more, are required. *X* rays are applied as vigorously as is compatible with safety. One Sabouraud dose filtered through one or two millimetres of aluminium is given to each side of the thyroid weekly in about twenty minutes. The heart is one of the earliest organs to respond, becoming regular and of normal size. After some time exophthalmos usually disappears and the goitre diminishes. The only risk is that of temporary pigmentation of the skin occasionally going on to telangiectasis.

Scottish Women's Hospitals.

In September, 1914, an Edinburgh graduate, Dr. Elsie Inglis, was instrumental in promoting the formation of the Scottish Women's Hospitals for foreign service, and units consisting entirely of women were arranged for Belgium, France, and Serbia. The first unit, intended for Belgium, was, owing to the German occupation of that country, sent to Calais. It was not a complete unit, but consisted of a staff of doctors and ten nurses under Dr. Alice Hutchinson. It worked during the severe typhoid epidemic among the Belgian soldiers under Dr. Depage from November, 1914, to April, 1915; the mortality among its patients was relatively low.

Work in France.

At the beginning of December, 1914, the first complete hospital unit was sent out under the French Red Cross, and was established in the Abbaye de Royaumont. Within easy distance of a large evacuating station the Abbaye, from its size and situation, proved to be an excellent site. Although within sound of the guns, its architectural beauty and the forest scenery in the neighbourhood made it an ideal spot in which the wounded soldier could forget for a time the horrors and discomfort of war. After inspection by the Service de Santé the hospital was opened on January 13th, 1915, as Hôpital Auxiliaire 301, fully equipped for the reception of surgical cases.

Dr. Agnes Savill has described the difficulties encountered in making the first *x*-ray installation. An *x*-ray room was fitted up close to the operating theatre and a developing room was contrived in a large cupboard with a fish-kettle as a cistern. In spite of this the developing was easily performed until there came a rush of work. Then a village plumber, who had known the abbey in the days of the nuns, found a cold water pipe in a cupboard on the first floor. This space was promptly fitted up as a developing room, but experience of the first months proved that it was possible to turn out good work without all the luxuries and conveniences to which students trained in a medical school are accustomed.

In a short time a bacteriological laboratory was added, a theatre, and an elaborate *x*-ray installation were equipped, and the number of beds was increased to 400. The cloisters lent themselves very well for the open-air treatment of wounds, and the large halls on the ground floor made it possible to wheel the beds out so that a large proportion of the cases could spend part of the day out of doors.

The medical staff included a surgeon-in-charge, five assistant surgeons, an anaesthetist, and a bacteriologist; there were thirty trained nurses, and about forty women orderlies, usually untrained volunteers who worked in the wards as probationers, helped in the kitchen, looked after stores, carried stretchers, and assisted in all the departments under trained heads.

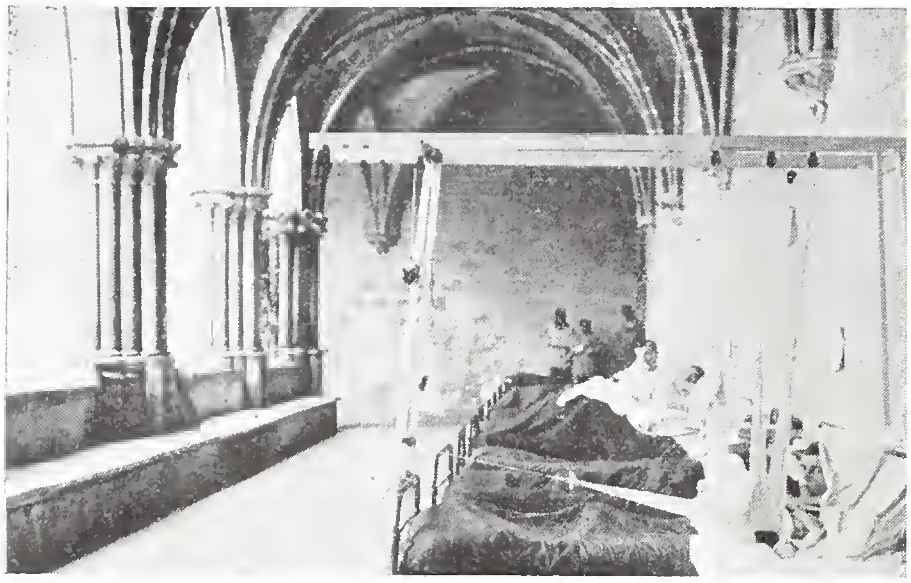
FIG. 1.—The Cloisters, Abbaye de Royaumont. Photograph reproduced in *Proc. Roy. Soc. Med.*, February, 1917.

The wounded are brought in from the military evacuating station by motor ambulances under the charge of women drivers. This is responsible work, for trains frequently arrive at night, the roads are by no means ideal, and during a rush the chauffeuses must work many hours without a break.

An *x*-ray car enables the radiologist to do radiographic work for those neighbouring hospitals which have no installation.

From the start the work of the Royaumont Hospital has been continuous, though in the early summer of 1916 the hospital was almost cleared in preparation for the attack on the Somme. The refectory was then arranged as a ward with 100 beds, and in a few hours, on July 2nd, was almost filled with seriously wounded cases.

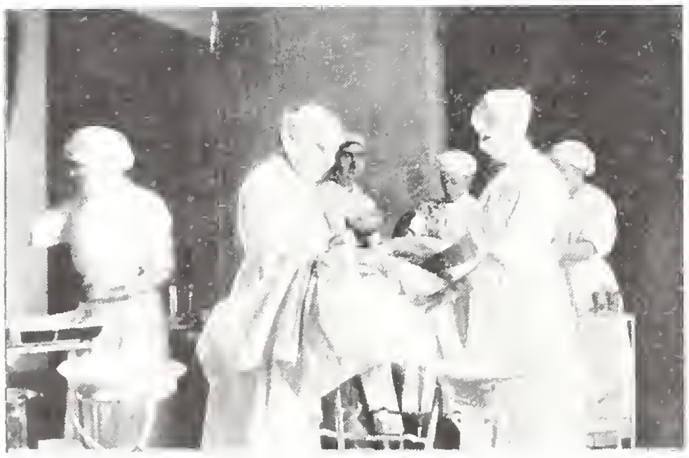
FIG. 2.—The Theatre.

In two years 2,527 patients had passed through the hospital and 2,859 operations had been performed, with a mortality of 48 (1.9 per cent.). Cases of almost every type of severity were admitted, but when an attack was proceeding they generally included a percentage of cases of gas gangrene. The operations performed included 1,057 for shell and grenade wounds, 264 for bullet wounds, 68 amputations and 59 reamputations, 78 joint operations, 176 for radical cure of hernia, 41 for appendicectomy, and 60 nerve and tendon operations. In addition, 200 civilians from the district were admitted for operative treatment. Miss Ivens, M.S., Médecin Chef of the hospital, has made a report on 464 cases of gas infection, of which 107 were clinically gas gangrene. Attention was drawn to the importance of complete bacteriological study and the careful examination of the *x*-ray plates, which, in the majority of cases, showed the presence of gas bubbles or streaks according to the species of microbe present, thus affording extremely valuable aid in a decision as to the form of treatment required.

It was found that the flora of gas gangrene was usually multiple: *B. perfringens* was present in nearly every case, *B. sporogenes* in 41 cases, *Vibrion septique* in 6 cases (several fatal): *B. histolyticus*, *B. Hibler IX*, and *B. oedematiens* were all reported, but less frequently. Streptococci of a virulent type were present in 59 cases, and added to the gravity of the infection. Tetanus occurred in 15 cases, and was demonstrated bacteriologically in 7. Of 464 cases of gas infection 42 were fatal, 25 dying from gas gangrene, 4 with tetanus, and the remainder with severe fractures, brain or abdominal injuries.

Amputation was considered necessary in advanced cases of gangrene; it was performed 65 times, with 48 recoveries, by the open method with lateral incisions. When gangrene was limited to groups of muscles or joints, excision was performed—41 times, with 33 recoveries. Hypertonic salt treatment alone was found to be unsuccessful, but combined with $2\frac{1}{2}$ per cent. carbolic acid had given good results. Other methods used, such as continuous irrigation with eusol, Dakin's solution, or normal saline, apparently gave the same results. Ten cases of very severe gas gangrene were treated by antiserums for *B. perfringens*, *B. oedematiens* and *Vibrion septique*. In five cases (one being an instance of septicaemia with triple anaërobic infection) the results were successful. The fatal cases were already septicaemic before serum was given. There was distinct evidence that its curative use might be advantageous and probably its prophylactic use even more valuable.

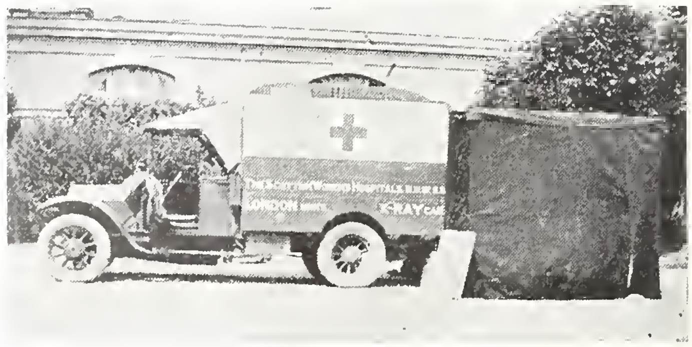
FIG. 3.—X-ray car with tent.

When the weather allowed, the sun was found to be a valuable aid in the treatment of wounds, which were exposed, with a thin layer of gauze to keep away flies.

Work in Serbia.

The Scottish Women's Hospitals sent out their first unit to Serbia in January, 1915, just after the Austrians had been driven over the Serbian frontier, leaving thousands of sick and wounded. Typhus of a virulent type was raging and the mortality was very high.

The unit went to Kragujevatz, the arsenal of Serbia, where it took charge of 570 beds. The first hospital was prepared in about forty-eight hours. The patients were in a miserable condition, many suffering from septic wounds and bedsores. They were found in all available buildings in the town shivering and verminous. To deal with the large numbers Dr. Eleanor Soltau in a short time opened other buildings with fresh equipment sent from Scotland. At Valjevo 70,000 typhus cases were lying unattended; some were sent at once to Kragujevatz, and Dr. Alice Hutchinson was sent with another unit to open a camp hospital at Valjevo. On its way out the unit stopped for a short time at Malta to nurse British wounded from the Dardanelles. Next Dr. Elsie Inglis arrived in Serbia and opened two additional hospitals, one at Mladanovatz and the other at Lazarovatz. The former hospital was named the Neil Fraser Memorial, after a member of the first unit who had died of typhus. This hospital was under the charge of Dr. Beatrice Macgregor, and was continuously full. The hospital at Lazarovatz, housed in inns and dwelling-houses of the village, was able to accommodate 400 patients.

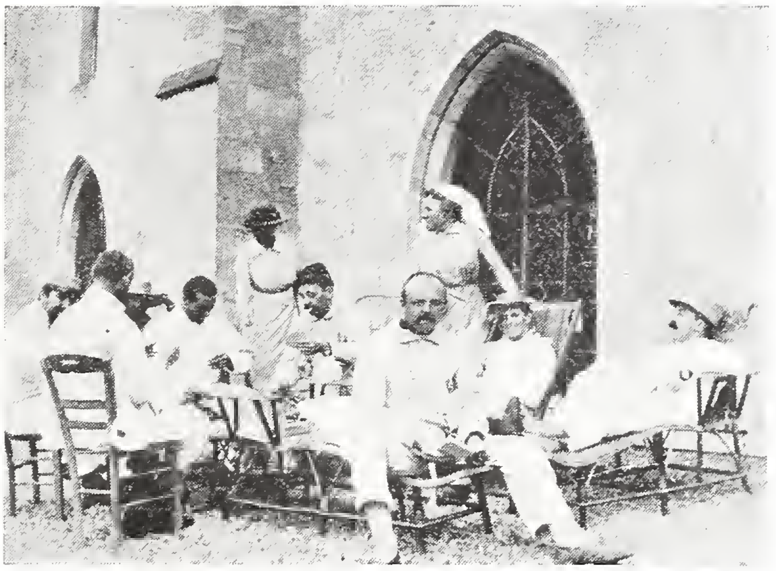

Fig. 4.—Convalescent French soldiers on the terrace.

In an account of some of the medical work done during her ten months in Serbia, Dr. Chesney has reported that 100 out of the 300 officers of the Serbian army medical service died from the fever, and that the Scottish Women's Hospital unit, to which she was attached at Kragujevatz, also suffered severely. Two buildings were taken over at Kragujevatz, so that cases of recurrent fever could be separated from typhus, but in a short time the wards contained nothing but typhus. The windows were kept open, and only one patient was allowed in each bed. The patients were washed, and lice hunted out of every hiding place; but fleas were ineradicable. The bathing arrangements and water heating apparatus were rough but efficient, though fuel was difficult to obtain. The sanitary arrangements were primitive; they consisted of a room with a small hole in a wooden box over a cesspool, and when this was filled up another small room was taken and another cesspool constructed. The cesspools were emptied by suction pumps and carts at intervals. Kragujevatz has normally a population of 10,000, but during the war there were about 20,000, and only five sanitary carts could be allowed for the town. With all its disadvantages the results in the hospital compared favourably with most of those in Skopliji and Banja, where buildings and sanitation were good. Each ward had two English sisters, and a Serbian and two Austrian orderlies. The Austrians made good nurses, and the Serbians preferred their ministrations. They were decent, friendly, and hard working. The sisters maintained discipline with ease by means of a sign language.

Fig. 5.—Scottish Women's Hospital for Serbian refugees in Corsica.

Typhus was at its height in February. It was of a very severe type and the death-rate extremely high. Nearly all cases were in the sixth or seventh day of illness when admitted, with the rash well out. Strong patients seemed to suffer most severely; the delirium was more severe, and when this persisted the case was nearly always fatal. The Austrian prisoners often died from heart failure just before the crisis; the majority of deaths were just at the crisis. In the Serbian hospitals the most common complication was gangrene of a moist type, but Dr. Chesney had no such cases, although numb and painful feet occurred not uncommonly. Eleven bullock wagons were sent to the surgical hospital laden with patients suffering from post-typhus gangrene, in an appalling condition from want of nursing. Post-typhus pneumonia was fairly common. The patients responded to good nursing, and the death-rate at this 6th Reserve Hospital was about 16 per cent., which was very low considering the violence of the epidemic.

The precautions against lice taken by the staff were to wear high boots, and to protect the wrist and neck with bandages rubbed with naphthalene. With the advent of summer typhus rapidly died down, the cases became milder, and finally ceased. Recurrent fever followed the same course, and during the summer, except for diphtheria, Serbia was quite healthy.

The Scottish Women's Hospital units worked in Serbia through the summer of 1915 until the advance of the Austro-German army swept them back. First, the Mladanovatz unit, which had treated more than 1,400 cases, had to fall back on Kragujevatz. Next, the Valjevo hospital had to retreat west to Vrnyatochka—Banja, where the members were made prisoners of war and taken to Hungary. The Lazarovatz unit retired to Kurfevatz.

Sir Ralph Paget, British Commissioner, arranged for those who wished to retreat into Montenegro. They endured terrible hardships travelling over snow-capped mountains 7,000 feet high, with food at famine prices, and shelter often not procurable, but with one exception all reached the coast in safety. In Kragujevatz during the first three months of the enemy occupation the care of a large number of Serbian wounded was given over to the Scottish Women's Hospital, and as there was great overcrowding an outbreak of typhus was feared, and an infectious hospital was organized with difficulty, as the Germans would give no other building. Bathing arrangements were improvised and disinfectors set going. The sanitation was deplorable, and it was necessary to empty the overflowing cesspools, to build incinerators, and to clean incessantly. Thousands of Serbian prisoners taken in the south passed through Kurfevatz miserably underfed. Their sufferings from hunger and exposure were very great. Hospital rations were meagre, and any extra articles, such as milk and eggs, were liable to be seized at the hospital gates by the Austrians. On February 9th the hospital was evacuated. The greater number of patients had been removed to Hungary, and the few remaining, badly wounded, were taken into Austrian hospitals. On February 11th, 1916, the entire hospital staff was sent north under an Austrian guard. In Vienna the Austrian Embassy took charge of them, and they were finally sent home through Zurich.

Work in Salonica.

In May, 1915, the second French hospital under Dr. McIlroy was opened at Troyes. It was established in tents, and at the end of the summer was sent with the French Expeditionary Force to the Balkans. For a month it was stationed at Ghevgeli, and cases were received from the front, which was about fifteen miles away. Orders were then given to evacuate, and the hospital retreated to Salonica, where it opened as a tent hospital on January 1st, 1916, on a stretch of flat ground near the sea, overlooking the bay of Salonica. The medical staff consisted of five women doctors and a radiologist. The climate of Salonica was found very trying, and there was a considerable amount of sickness among the staff during the hot season, when the work was heaviest, 1,000 patients being admitted during July and August with dysentery, malaria, colic, diarrhoea, and jaundice. In October, when active hostilities began again, the hospital was used for wounded. The x-ray department treated a considerable number of cases with high frequency, electrical massage, hot air, light and ionization, under the direction of Miss Edith Stoney; cases were sent also from other hospitals for treatment. During the year 3,045 patients were admitted.

Work in Corsica.

Some of the Scottish women who had been in the Serbian retreat in December, 1915, appalled by the sufferings of the Serbians, undertook, with the approval of the French Government, the provision of medical care for the Serbian refugees in Corsica, and looked after them during their transport from Salonica to Corsica.

Dr. Blair landed in Ajaccio with the first transport full of Serbian refugees on Christmas eve, 1915, and took medical charge of the Serbian colony there. The refugees on the island at one time numbered 6,000. The first Serbs to arrive were from Southern Serbia, some civil officers and their wives and families, some peasants, but all at that time equally destitute, as they had fled before the Bulgarians, leaving everything behind them, and had suffered great privations. The maternity work started before the refugees reached Ajaccio, for a child was born on the first transport. There was a considerable amount of illness among the refugees, the result of exposure, privation, and exhaustion, and there was ever present the possibility of infectious disease. A suitable building was turned into a hospital, which was soon filled with patients, as, in addition to all the serious cases from the refugee colony, numbers of young recruits arrived from Corfu. They had been in the retreat through Montenegro and Albania. The condition of these starving boys was most pitiable, and the most devoted nursing was not always successful in restoring them to health after the privations they had endured. Tuberculosis was extremely common. The most pathetic group of all to arrive were the school boys and students, who from 11 years upwards were marched to the Adriatic lest they should fall into the hands of the enemy; several thousands died by the way, thousands more after reaching the base, so many that the isle where they were quartered came to be known as L'Ile des Morts. The boys who recovered in the hospital were sent first to Great Britain and later to France.

The medical service for the Serbs consists of the main Scottish Women's Hospital at Ajaccio, the branch hospital for isolation (the Lazaret), and out-patient dispensaries at the refugee houses.

During the autumn of 1916 the hospital began to receive discharged incapacitated soldiers. It has over eighty beds occupied and is equipped with a theatre, pathological laboratory, and an x-ray installation. There is an open-air department for phthisis, and sun baths are an important part of the treatment. More than 2,000 patients were treated at Ajaccio alone. The Serbs were found to be extraordinarily interesting and grateful patients, and very much endeared themselves to their British nurses.

In the autumn of 1916 the second Serbian army was mobilized and re-equipped at Corfu. The Scottish Women's Hospital received an invitation to send out a unit with it, and Dr. Agnes Bennett went to Salonica in charge of a well equipped hospital of 200 beds. The movements of the unit, which was attached to the Serbian army, were facilitated by the possession of motor transport sufficient not only for the wounded but for the staff. The hospital was first located near Salonica. Later on it was moved to Ostrovo. The bad roads and heavy hill climbing made the transport difficult and dangerous. This hospital received many wounded from the Serbian army during its advance and proved of the greatest value to it. When the army moved forward a small outpost station was sent ahead to enable the most serious cases to be looked after for a few days before being transported over the bad roads. Mrs. Harley, sister of Lord French, who was killed recently in Monastir, was in charge of the transport column.

Work in Russia.

Another unit was sent out through Russia for the 1st Serbian Division of the Russian army in the Dobrudja. It was in charge of Dr. Elsie Inglis and Dr. Lilian Chesney, and started work in October, 1916, at Mejidia, where the barracks were converted into a hospital. About 300 patients were received during the eighteen days of its existence. Owing to the rapid advance of the Bulgars, it had then to be evacuated.

Meanwhile a second hospital had been established at Boulboulmick, consisting of three hospital tents and a dressing tent; after being occupied for a fortnight, it, too, had to retreat to a village near Mejidia. The final retreat was slow and arduous, and great hardships were suffered. The hospital equipment was transported through Cernavode by stages to Ismail and Galatz, and ultimately into Russia, only a motor kitchen and ambulance being lost. Dr. Inglis established dressing stations at Harsova and Braila and found many wounded at the latter place. The unit, when last heard of, was at Bessarabia, across the Russian frontier.

Work under the British War Office.

On leaving Paris Dr. Garrett Anderson and part of her staff did good work for some months at Wimereux in association with the R.A.M.C. It was then arranged by the Director-General, Sir Alfred Keogh, that they should organize a military hospital at Endell Street Workhouse Infirmary, London, which they have since conducted with great efficiency.

[Other medical women, among whom Miss F. Barrie Lambert, M.B., may specially be mentioned, have taken their share in the treatment of wounded men in the convalescent and command dépôts mentioned by Dr. Colin Mackenzie in Chapter VIII.]

CHAPTER XIV.

THE ROYAL ARMY MEDICAL CORPS AND ITS WORK.

THE general work of the medical service of the British army may be regarded as falling into three main sections:

1. The physical and environmental hygiene of the soldier's life.
2. The evacuation of sick and wounded from places at which their presence is an obstacle to the success of military operations, and detrimental to the men themselves; and
3. The provision and maintenance of institutions at which sick or wounded soldiers can remain during treatment.

In theory, and to some extent in practice, the area in which the work has to be done is divided into three zones. The first or forward area is known as the "collecting zone" (Fig. 1). In it the wounded are collected from the battle-field, and the sick from the places at which they fall ill. Theoretically it is an area of the shape of a triangle, connected by its apex with the lines of communication, and having at its base the regiments in action; and nominally it contains only the regimental aid-posts, the field ambulances, and a "casualty clearing station," or railhead hospital, which stands at the apex, and serves to house the sick and wounded sent on from the field ambulances until they can be passed down through the evacuating zone to the distributing zone. In practice, however, it contains certain other units of a medical character.

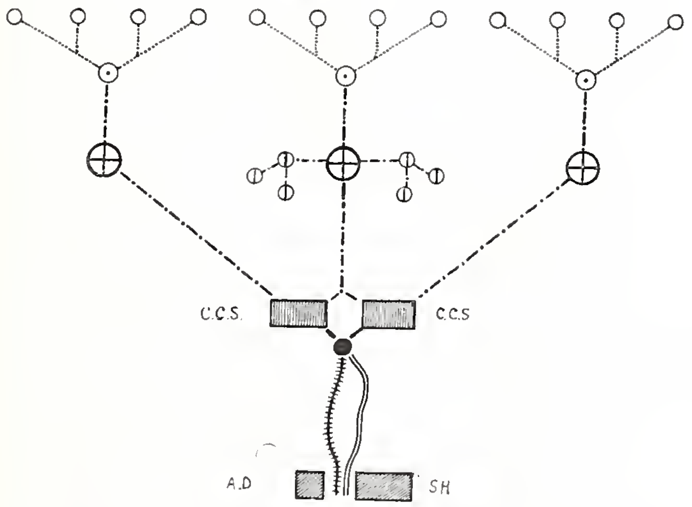

FIG. 1.—*Collecting Zone.* Diagram representing the distribution of the medical units. The plain circles are regimental aid posts. The circles with a dot in the centre are advanced dressing stations, and those with a cross are main dressing stations of field ambulances The circles with a vertical line through them are rest camps and other annexes to main dressing stations. The upper oblongs are a couple of casualty clearing stations connected by road with the field ambulances and with the base by a railway line and canal traversing the evacuating zone. The oblong below (S.H.) is a stationary hospital in the evacuating zone. Opposite it is an advanced dépôt of medical stores (A.D.).

The next or middle area is known as the "evacuating zone," because it is traversed by the roads, railway lines, or canals along which the sick and wounded are carried on their way to the distributing zone. It corresponds with the military area known as the lines of communication, and, theoretically, is long and narrow, containing, from a medical point of view, nothing but the various means of transport, and perhaps a medical store or two and a few "stationary" hospitals for the reception of patients who should not be taken any further towards the distributing zone.

The third or lowest area is called the "distributing zone," because in it are placed the various institutions among which the sick and wounded are to be distributed to receive their final treatment. It is an area of indefinite size, corresponding roughly to that in which munitions of war are gathered and reinforcements collected, and which, from a purely military point of view, is known as the base. In this war it lies partly in Great Britain, partly overseas, and consequently it is common to speak of it as if it contained institutions of two different orders—"home hospitals" and "overseas or base hospitals."

The collecting zones in France may be regarded as divided into sections, each with its own line of communications and a railhead, for the front is actually held by different armies each of which has its own area of operations. Each such area is in medical charge of a senior medical officer known as Director of Medical Services (D.M.S.), who is responsible for the arrangements he makes only to the general of the army to which he belongs, and to the principal medical officer of the British forces—that is to say, the Director-General of Medical Services on the staff of the Commander-in-Chief.

In the collecting zone, even in parts of the area full of suggestions of the industries of peace, the dull booming of the guns is rarely inaudible, while a few miles further afield the road is encumbered from time to time by ammunition wagons, by ambulances, by fresh battalions going up to take their place in the line, or by battalions returning to their billets mudstained and worn. The hill-tops, too, disclose a view perhaps of swiftly moving aeroplanes, a line of observation balloons, and the rising smoke clouds formed by bursting shells.

This area has an atmosphere all its own—bracing, suggestive, thrilling, yet curiously solvent of illusions and of personal petty ambitions. That is its effect, at any rate, on many a newcomer. He sees himself suddenly from a new angle; he recognizes that he has arrived at a place where there is no room for the looker-on at life, at a place where men justify their existences by work and their deaths by altruistic aims, and where nothing counts but the war.

The various sections of this zone are each, as has been said, in charge of a director of medical services, who works through the deputy directors (D.D.M.S.) in charge of the corps into which every army is divided, and these again through the assistant directors (A.D.M.S.), who are responsible for the medical work of the divisions out of which army corps are constituted.

The number of men in a division is roughly 20,000, and to meet their needs each A.D.M.S. has at his disposition the personnel of three field ambulances, and twelve or more medical officers attached to single battalions or like divisional units.

BATTALION MEDICAL OFFICERS.

The battalion or regimental medical officers do their work in a more advanced position than any others, and in some respects are the most important components of the whole medical service.

Each is as it were the family medical attendant of the men of the unit, the medical officer of health of the locality in which it may for the moment find itself, and the private medical adviser of the commanding officer in respect of all questions in which medical considerations arise. He gets, or should get, to know the mental and physical peculiarities of every officer and man in his battalion—knowing, for instance, such things as who have dubious feet, who a nervous constitution, who are exceptionally hardy, who are careless in their living, who careful, who are disposed to go sick on the least excuse, who will never report themselves until positively obliged. He acquires this knowledge by going about among the men, by his formal medical inspections, and by noting who are the frequent attendants at his morning sick parades, and why they come. Bearing in mind that the sole reason why the men are in his charge at all is in order that they may fight, and fight effectively, he treats them much in the spirit of the medical attendant of a racing crew. Hence he is always endeavouring to tackle small evils early, and to winnow out the sick to whom he can afford all necessary treatment himself from those who must be sent elsewhere.

Everything that can in any way affect the health of his unit comes within his purview: food and its preparation, the sterilization of the water supplies, the provision of latrines and their proper maintenance, the destruction of rubbish, and the cleanliness of billets and dug-outs. He is always, too, on the alert for the first signs of an outbreak of any epidemic malady, wages war on parasites and flies, and endeavours to ensure that the men appreciate the importance of the various precautions they are told to observe, including those against trench feet. His authority he derives partly from his personal position, partly from his influence with the commanding officer of his battalion. If he secures the confidence of the latter, and the real respect of the adjutant and the sergeant-major, his work is, from one point of view, easy.

His duties are continuous, whether his unit be resting in billets or be taking its turn in the fighting line.

TRENCH WORK.

If it be taking its turn in the fighting line he has also to attend to battle casualties and their evacuation, his precise duties in this connexion differing according as trench fighting is in progress or an "over-the-top" advance.

In the former case he does his work from a predetermined point chosen according to the lie of the ground and other circumstances, at or close sometimes to the head quarters of one of the companies of the battalion or sometimes to those of the battalion itself. The former are likely to be in a dug-out or trench some two or three hundred yards behind the fire trench, and the latter perhaps twice or three times that distance (Fig. 2). Here he establishes a first or regimental aid post, equipping it with the ordinary provisions of a surgery, coupled with bunks or other lying-down accommodation for, say, half a dozen seriously wounded men (Figs. 3 and 4).

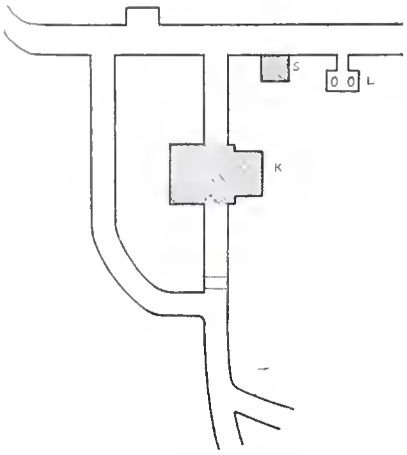

FIG. 2.—Map, drawn from memory, showing the position of a certain regimental aid post lying between a main and an accessory communication trench. The shaded block is the post itself. It stands across the trench, the patients approaching along the curved trench and leaving by the straight descending trench, which leads to the advanced dressing station. The ascending arm leads to and from the firing line. The projection (K) on the right is the aid post kitchen. The projection (L) is the latrine. The small shaded projection (S) is a dug-out for four R.A.M.C. stretcher-bearers.

The aid post itself may be the cellar of a ruined cottage or house, a deserted German dug-out, or an ostensibly shell-proof annexe to a communication trench, but whatever its nature he endeavours to guard his patients against a gas attack, providing for all openings a blanket screen soaked in an anti-gas solution which can be lowered into place at a moment's notice. Also, if the accommodation of the post be at all considerable, he takes what steps he can to divide it up in such fashion that no single shell is likely to affect all parts of it.

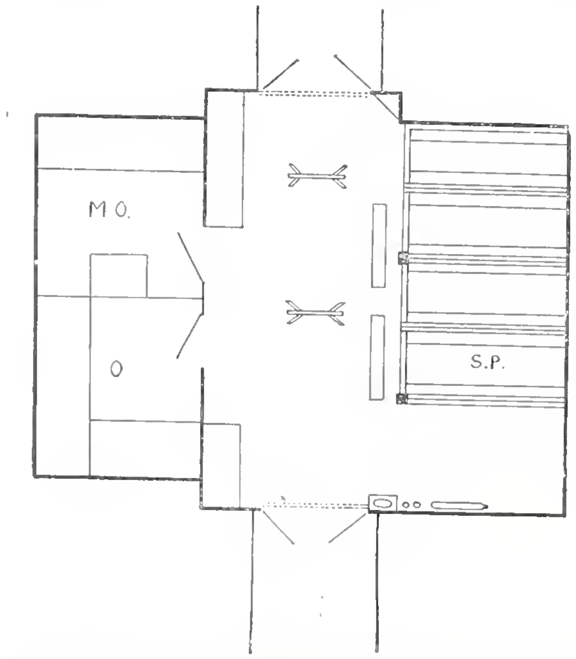

FIG. 3.—Ground plan of a regimental aid post shown in elevation in Fig. 4. On the left (O) is a bunk for two orderlies, each having his stretcher bed; next is the M.O.'s bunk, with a stretcher bed and table. In the centre compartment running from entrance to exit are trestles to support a stretcher while a case is being dressed, some tables and shelves for bottles and instruments, and two sitting benches. On the right is an empty space for storing the kits of patients, and beyond are slides, each to hold three stretcher patients, in tiers (S.P.). A curtain separates them from the centre compartment. Gas-proof curtains are rolled up above the doors ready to let down on a gas alarm, and on the floor near the exit is a cylinder of oxygen and a spraying machine and some bottles of anti-gas solution.

To assist him he has a corporal and four men of his own corps, their specific duty being to look after the water supplies; he draws from the battalion a lance-corporal, a driver for the small cart in which he carries about his aid-post outfit, and from each half-company one man whose specific duty is sanitation. The unit also supplies him with men to act as stretcher-bearers in the proportion of two to each half-company, or sixteen in all. His total command therefore consists of twenty-nine men, all of whom he trains in stretcher-bearer and first-aid work, but otherwise employs as he finds advisable. Subject to the specific duties mentioned he usually posts most of his men along the trenches held by his unit in order that they may be ready to attend the casualties when the cry "stretcher-bearers at the double" is passed from sentry to sentry.

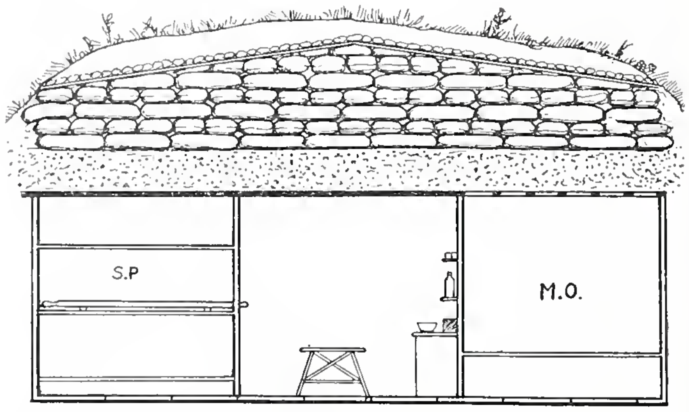

FIG. 4.—Elevation of the regimental aid post shown in Fig. 3. Tiers (S.P.) for stretchers for patients are seen on the left (one in position), and the M.O.'s bunk and stretcher bed on the right. In the middle is a trestle to support a stretcher while the case is being dressed, and near it a bench for bottles and dressings. Sufficient height for work (about 6 ft. 6 in.) is secured by slightly deepening the trench, inflow of water being prevented by a dam and sump pit. The floor is concrete; the roof, concrete, sand-bags and earth. Light is supplied by acetylene lamps.

The medical officer visits the fire trenches whenever occasion occurs, and often merely to encourage the men by the knowledge that should they be wounded skilled attention is at hand; his assistants are, however, competent in ordinary cases to apply the first-aid dressing which every soldier carries inside his tunic; if feasible, the wounded man is then removed to the regimental aid post. Consequently, it is here that the medical officer habitually remains.

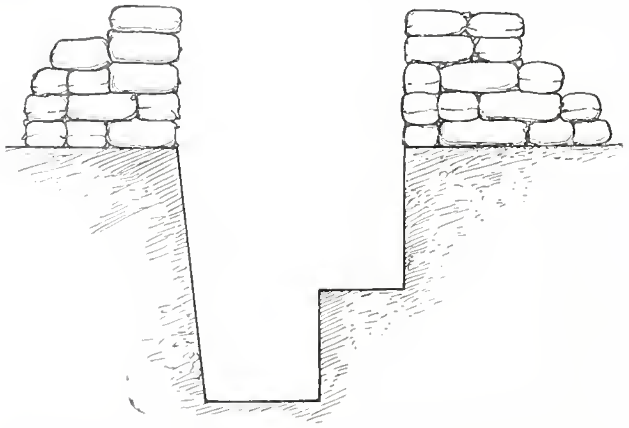

FIG. 5.—Diagram representing a section through a fire trench, measuring about 2 ft. at the bottom, about 4 ft. at the upper ground level, and about 6 ft. 6 in. from top to bottom. The shelf at the side, or fire-step, can be used as the foundation for a stretcher bed when the bottom of the trench is full of water.

If, however, the injury be a fracture of the lower limb or other serious condition, or the man cannot be brought back to the aid post forthwith, the medical officer goes up to see that the necessary steps are taken. These will always include the placing of the patient in some position in which he will be out of the way of the fighting men, while if the trench be waterlogged or the weather very rainy, and the patient helpless, it may be necessary to build him up a bed out of a stretcher on the fire-step (Fig. 5), or elsewhere above the water line, protecting him from cold and wet by blankets and a waterproof ground sheet.

The difficulty of getting a case out of the trenches varies with its nature, with the amount of the fighting that is in progress, and with the character of the trench leading from the place where the casualty has occurred to battalion head quarters. A plan of a common type of trench is shown in Fig. 6. Should the communication trench have been knocked about recently or be waterlogged, it may not be easy even for an active and unloaded man to get along it, and in the best of circumstances the transport of a wounded man along the trenches is a problem presenting much difficulty.

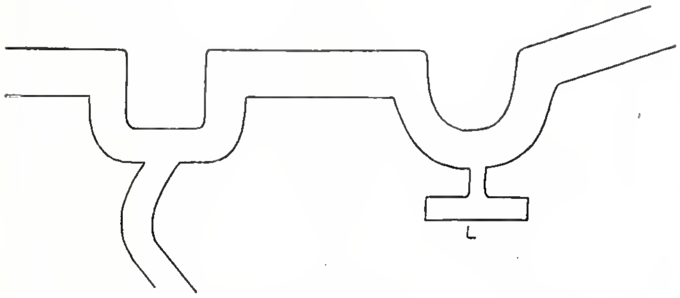

FIG. 6.—Outline of a common form of trench with traverses projecting towards the rear. The straight parts are the fire bays. On the left is the beginning of a communication trench. On the right is a latrine (L) leading out of a traverse. Many of the angles of such a trench are worn away.

Certain types of new trench (Fig. 7) may be nowhere wider than 24 in., while the average width of a fully-developed trench is not more than 4 ft. at the level of the shoulders, and its course is invariably interrupted by angles round which an ordinary stretcher cannot be carried except by tilting. (Figs. 8 and 9.) Numerous special stretchers have been devised, and some of them meet their purpose if the communication trench is good, and especially if the trench in which they are being used be an old one and the corners of the traverses worn away.

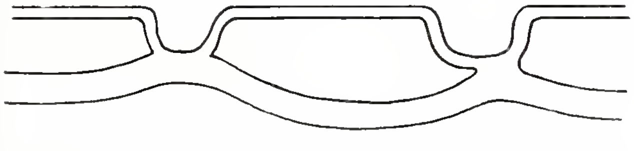

FIG. 7.—Diagram of a type of trench presenting special difficulties in moving wounded men. It is a twin trench of which the front one is never more than about 2 ft. wide and 4 ft. 6 in. deep.

Fig. 10 is a diagrammatic section of another type of trench in use where the ground water level is sufficiently low to allow a depth to be given to the trench sufficient to protect from rifle fire a man a little over six feet high.

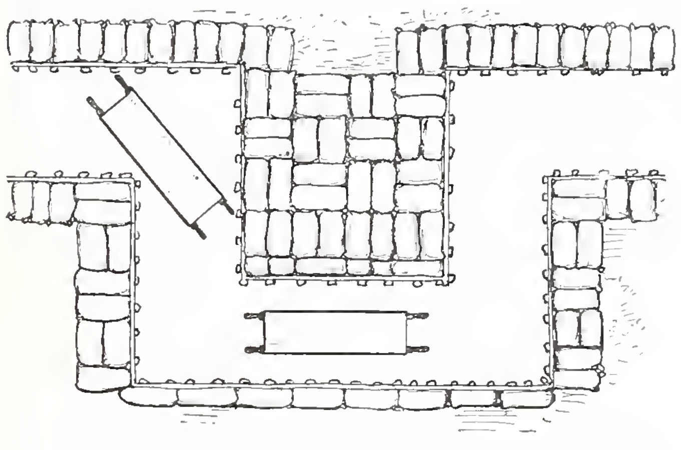

FIG. 8.—Diagram to illustrate the difficulty of getting a stretcher round the angles of a trench.

There are, however, many cases, as also many trenches, in which the special stretchers are unusable, so it is common for the problem to be solved by lifting the patient on a blanket or on a stretcher over the parados or back wall of the trench, and carrying him to the regimental aid post over the intervening ground. Should the trenches happen to lie at the top of an ascent this is a relatively easy process, but otherwise it can only be carried out after nightfall unless the need for removal is so urgent that the risk must be taken of the patient and his bearers all being killed.

When the patient arrives at the aid post every care is taken to obviate shock as far as possible by the administration of morphine and hot drinks, and by protection from cold. A label is attached to the wounded man briefly describing the nature of his injury, and, if some time is likely to elapse before he can be removed out of the firing line altogether, a dose of tetanus antitoxin is given. The medical officer's outfit includes everything necessary for such purposes, as also for the arrest of haemorrhage, the splinting of fractures, and the antiseptic treatment of wounds; but he is not expected or desired to undertake formal operations.

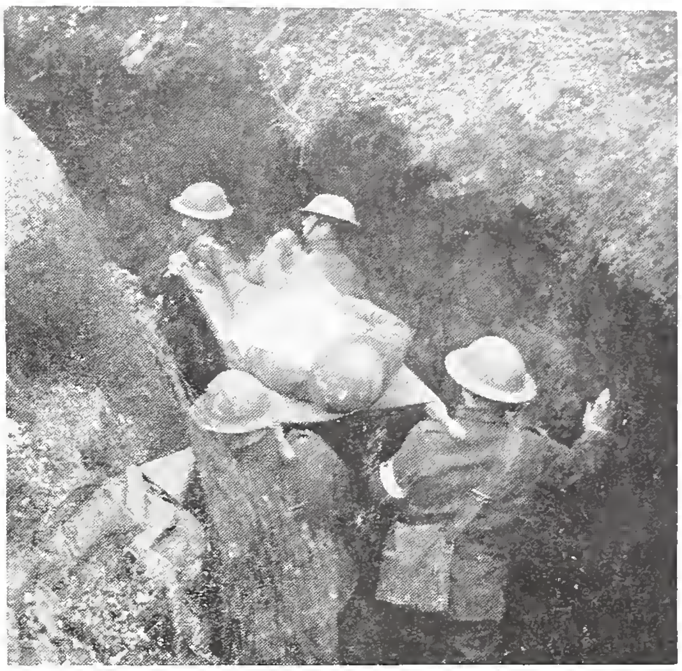

FIG. 9.—A difficult turn.

WORK IN THE OPEN.

If the unit to which he is attached be taking part in an advance, the duty of a battalion medical officer usually requires him to wait till the attack has been launched. As soon as he sees reason to believe that his battalion is holding its own, but that casualties are occurring, he advances with his men and hunts for a spot where he can establish a regimental aid post.

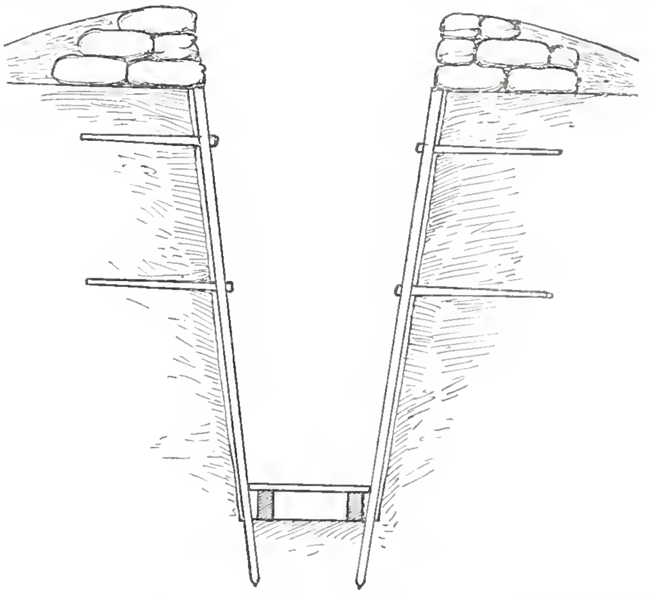

FIG. 10.—Diagrammatic view of a section of a communication trench dug in a part of the country where the subsoil water lies so low that only three layers of sandbags are required to secure protection from rifle fire for a man a little over six feet high. It has a boarded footway at the bottom, and the sides are lined with wire netting supported on spiked stakes. Although in perfect repair, its diameter at the bottom is only about two feet, and at the ground level about four feet.

If the area over which the attack is to be launched is well known because previously occupied or successfully reconnoitred by aeroplane or other observation, the front-line maps prepared for the use of the head quarters of the battalion going into action or occupying the front trenches may indicate to the medical officer where he is likely to find a good place for his regimental aid post. Otherwise he must trust to his own judgement and enterprise, selecting a dip in the ground, an enemy trench, a mine crater, a large shell hole, anything that will serve to protect his wounded from direct fire; in any case it is, if possible, near a road. He starts as soon as possible, not only because his services are needed, but also because the enemy, as soon as the attack has been launched, is likely to try and cut off the arrival of supporting troops by a curtain of shell fire.

His regimental aid-post having been established, and any patients that had been brought to it having been duly treated, the M.O. probably goes to see cases which his orderlies have found, but have not been able to move, or to which his attention is otherwise attracted. For these he does what he can, and if they cannot be moved to the regimental aid-post on account of their condition or the heaviness of the fighting, he tries to collect them into groups, so that they can be found again easily and moved later on. If the area over which his battalion has been fighting is extensive, he perhaps leaves an orderly in charge of the larger groups. The whole of this work is highly dangerous, since, apart from being done under rifle fire, the artillery fire intended to prevent the arrival of supporting troops often affects the neighbourhood in which the M.O. and his men are necessarily working.

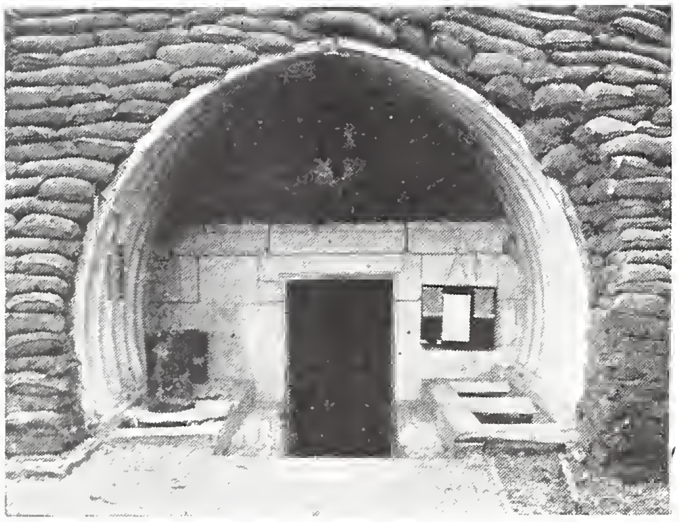

FIG. 11.—Entrance to advanced dressing station in the cellar of a partly ruined house

Of the men who are not so seriously wounded as to be unable to walk, a good many probably find their way straight to the rear after applying their own field dressings or getting them applied by a comrade. Others make their way to the regimental aid post, and there they remain with the stretcher cases until their wounds have been dressed and the firing slackens sufficiently to enable them to make their way to the rear.

The stretcher cases remain until ambulances come up to fetch them, and unless the fighting is very heavy this process of evacuation will begin very shortly after the action itself; otherwise it is likely to be deferred until nightfall, when in any case a search will be made of the area over which the battalion has been fighting.

FIELD AMBULANCES.

The medical unit lying next behind a regimental aid post is one of those whose functions, though not necessarily their organization, have been considerably augmented or otherwise varied since the war began, in accordance with local requirements.

Originally its main duty was to relieve of their sick and wounded the regimental aid posts, helping them also to clear the field at nightfall or whenever there was a pause in the battle, and treating the cases until it was possible to send them to treatment centres well away from the front. It had to serve in this way simultaneously three or four battalions, all presumed to be in action on an extended front, and the better to fit it for this work a field ambulance was made divisible into three sections, each capable of acting independently, and each again divisible into a stretcher-bearer subdivision for collecting the wounded and a tent subdivision for treatment of the patients.

In several of the localities in which the British army has been fighting during the last three years field ambulances have, no doubt, been working on this plan, but in France the conditions have necessitated a modification of their work and also to some extent of their constitution. Each remains divisible as before, and each still possesses ten vehicles for the conveyance of wounded, but seven of these are now motor ambulance cars, replacing seven horse-drawn ambulance wagons, and of the nine original medical officers one has been withdrawn. Furthermore, though every A.D.M.S. (senior officer of a division) still has three field ambulances under his direct command for the work of his division, and each of these retains its capacity to work as an independent unit, he sometimes combines forces with the A.D.M.S. of another division, or the field ambulances of all the divisions of an army corps are in effect massed.

The duties they collectively perform are now practically as follows:

1. To collect the sick and wounded from battalions, whether these be actually fighting, serving as supports, or temporarily resting out of the line.
2. To decide what cases must be evacuated, and what shall be treated at the front.
3. To provide permanent treatment for those who fail to pass through the filter thus established, and for the rest temporary treatment pending evacuation.
4. To pursue a like course in respect of local sick, that is to say, cases of illness or injury arising amongst the large number of men who never take part in the actual fighting, but whose presence just in the rear of the fighting line is essential to military operations.
5. To provide for the cleansing at frequent intervals of the persons of the men, the ridding of their clothes from vermin, and their disinfection when epidemic disease is in question.
6. To fill any gaps in the medical establishments of regiments, and to train medical officers and men for this work by sending them for a time to the battalions to see how regimental work is done.
7. To provide temporary assistance when needed to casualty clearing stations belonging to the army of which the divisional field ambulances form part.
8. To establish advanced operating stations for immediate emergency operations, such as those required in cases of abdominal wounds.
9. To supplement the sanitary work of battalion medical officers when the battalions concerned are located in places which are out of the fighting line but not in direct charge of the sanitary staffs of the army of which the battalions form part.
10. To do for divisions and corps any work for which provision has not yet been made by the army, and which requires for its performance the kind of scientific knowledge medical officers commonly possess.

It may be said, in short, of the British armies in France that their field ambulances are the medical *bonne à tout faire* of the front.

No single field ambulance ever undertakes simultaneously all the duties mentioned, and the way in which they are allocated varies; for the environment of the divisions are not identical, and the senior medical officer of each of the armies and corps on the Western front (subject to orders from a higher authority) exercises his discretion as to the fashion in which he provides for the aggregate medical requirements of the troops in his charge. The experiences of field ambulance medical officers are therefore liable to differ, more especially if the period over which they are compared is relatively short. Commonly, whatever duties have to be performed are taken in turn by each field ambulance available, the period for which it remains employed thereon varying according to circumstances.

If a division is engaged in an active part of the line its evacuation work is usually sufficient to occupy the attention of all its field ambulances, and the same is true of those of a corps when this is taking part in an advance or definite battle. In such cases the other duties are assigned to the ambulances of reserve or other divisions.

In trench warfare each division engaged generally makes its own arrangements for evacuation, the ambulances belonging to it sometimes acting as independent units, sometimes pooling their resources.

THE ADVANCED DRESSING STATION.

A section of the officers and men available is pushed up to form an advanced dressing station at some place within easy reach of the regimental aid posts of the battalions in action. They choose a place on or close to a road, so that the patients brought down from the battalion aid posts can be sent back rapidly from the advanced dressing station in wheeled vehicles to the place where the field ambulance head quarters or main dressing station has been established.

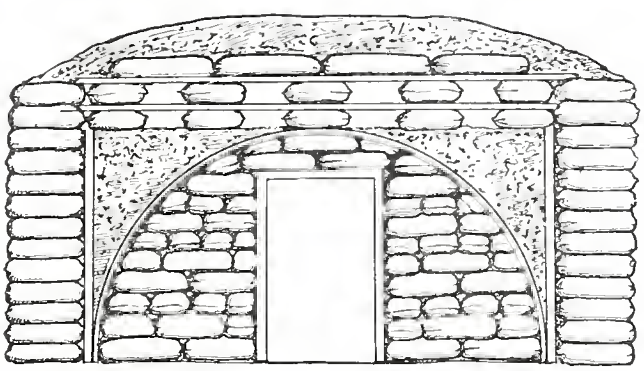

FIG. 12.—Diagram, drawn from memory, of the entrance end of a small "tube" above-ground advanced dressing station. It is built of curved sheets of corrugated steel surrounded by sandbags and earth, etc.

The advanced dressing station is always exposed to artillery fire, and though sometimes the crypt or cellar of a still standing but more or less wrecked building, such as a church or large school, may be available (Fig. 11) its habitation is, as a rule, merely an enlarged edition of a regimental aid post. (Figs. 12 and 13.) Its equipment and organization likewise resemble that of a regimental aid post, but is larger, because an advanced dressing station is rarely in touch with less than four regimental aid posts. To these it sends, as often as required, sufficient stretcher bearers to clear them of waiting cases, and if any considerable number of men have been left in the trenches till nightfall, it helps to remove them, and retains them till they are fit to be sent further towards the rear.

The way in which it brings down its patients varies in different parts of the line and according to the amount of fighting in progress. Sometimes patients are hand-carried all the way down through a winding communication trench a mile or more long. Sometimes they are carried straight across country, though the latter is possible only at night or when the ground traversed is dead ground—that is, an area which cannot be reached by rifle fire, and not too much hampered by wire entanglements. There are also a few places in which the trenches have an overhead tram-rail, and the wounded men can be transported on a special ambulance trolley suspended from it (Fig. 14), and many areas are provided with tram-lines along which run for the greater part of the distance to be traversed small lorries capable of carrying two or four patients. There are others at which it is possible for the advanced dressing station to clear some at least of its battalion aid posts by sending up a horse ambulance. The means most commonly employed, however, is a wheeled carrier, of which several types are shown in Figs. 15 and 16.

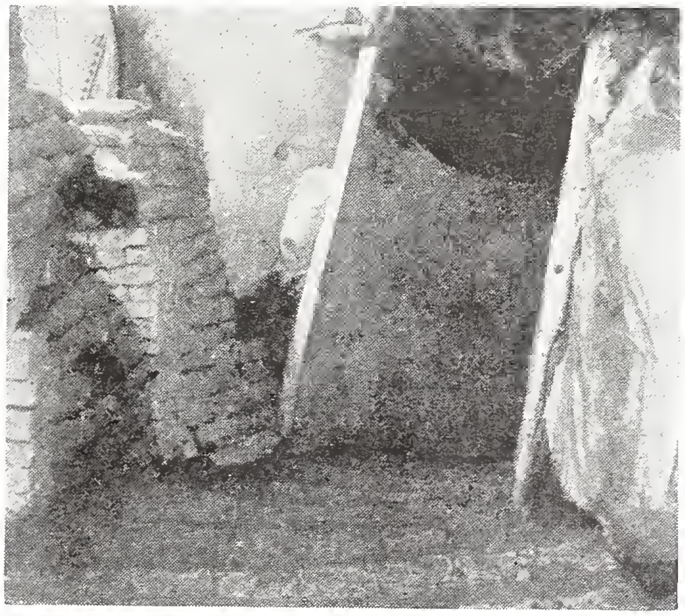

FIG. 13.—Leading down to a dressing station 30 ft. under the surface.

Once arrived at the advanced dressing station the patients are rested, fed and dressed, if necessary, and otherwise prepared to continue their journey, which in most cases will commence as soon as ambulance cars or wagons arrive from the field ambulance head quarters or main dressing station to fetch them.

Advanced Operating Station.

Commonly it is only by night that an advanced dressing station can clear the regimental aid posts with which it is in touch. In the case of an abdominal wound, however, considerations of risk from rifle and shell fire are set aside both at the regimental aid post and the advanced dressing station, and the patient is got down forthwith and sent to the rear in a special ambulance car, kept, if possible, for this purpose in a dug-out near the advanced dressing station, or summoned from the main dressing station or ambulance head quarters by telephone or messenger. The patient goes not to the main dressing station, but either straight to a casualty clearing station or to a field ambulance unit specially arranged for the instant performance of laparotomies, etc. Such a unit is called a corps or advanced operating station, and is established whenever the placing of a casualty clearing station within suitable distance of the part of the line concerned is likely to be delayed.

Varying Conditions.

The ambulance vehicles serving the advanced dressing stations almost always have to traverse roads exposed to shell fire, if not to rifle fire, and efforts are made in various ways to protect their occupants from further injury. When only trench warfare operations are in progress most of the work is done under cover of nightfall, though the depth of the darkness may be disclosed from time to time by the flashing of guns, bursting of shells, and the soaring of rockets. The ambulance transport which comes up to fetch the patients approaches and leaves the advanced dressing stations, as it were, stealthily; and, after anything like a quiet day, two or three trips at most may complete the whole evacuation.

When, however, the division or corps is taking part in an advance or definite battle the reverse is the case. Hour after hour and sometimes for weeks there is a constant inflow of stretcher-borne men, and ambulance vehicles continually arrive to carry away the patients who have received the attention they require; on these occasions the only precautions taken are to keep at a sufficient distance apart so that no single shell shall have the chance of destroying two cars, and to travel sufficiently slowly to avoid jolting the injured more than is inevitable on the shell-pitted roads. It is commonly not until the battle has commenced that an advanced dressing station can take up its position, though the site may have been chosen in advance. As it must always be on a road, so as to ensure rapid evacuation yet never run the risk of impeding the military work in progress, the choice is often very limited. More likely than not it will be in a deserted trench or enemy dug-out, but it is always contrived so that the incoming and outgoing streams of wounded shall not meet, and that the more serious cases can be dressed separately from those that are slight. Provision is also made for cases which may have to be kept for some little time on account of their condition, and for protecting them from gas attacks.

Divisional Collecting Post.

The majority of cases with which it deals are "lyers"—that is to say, men who reach it on stretchers. The "walkers"—that is to say, men who can find their own way to the rear—are usually shepherded off by patrols in advance of the dressing station to another field ambulance station known as the divisional collecting post, established when a big advance is in progress.

If the area over which the corps is fighting is wide, it usually establishes two advanced dressing stations and two divisional collecting posts in different parts of the field. The field ambulance medical officers at its disposition may be sufficient for this purpose, but in respect of stretcher-bearers it is always short-handed if the fighting be really heavy, consequently on these occasions its own stretcher-bearers are reinforced from various sources.

If the troops in action are very successful and make a prolonged advance, an advanced dressing station may no sooner have established itself to its own satisfaction than it has to make a fresh move to get into close touch with the regimental aid posts.

It will be obvious from what has been said that work in and around advanced dressing stations, whether in trench warfare or in a definite battle, is attended by considerable risk. The fact that it is often exceedingly laborious may not be so apparent. If the fighting is at all heavy, the work as a whole continues without pause for many hours; and while the carriage of a full-grown man over a mile or so of rough ground is never a light task, it becomes absolutely exhausting when at each step the bearers have to drag their feet out of thick mud, and when their clothes, like those of the patient, are soaked with rain.

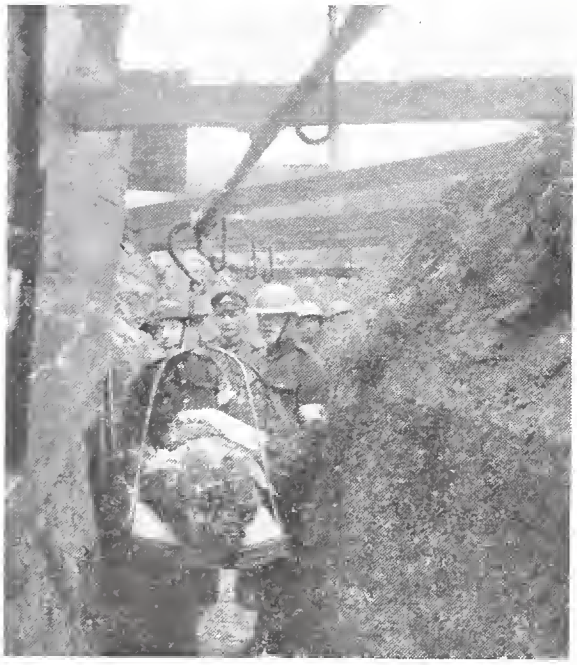
Fig. 14.—The overhead trolley for bringing the wounded through the trenches.

The Main Dressing Station.

The main dressing station is formed by the head quarters of the field ambulance or group of field ambulances responsible for the maintenance of the advanced dressing stations. As it is liable to have to retain the sick and wounded sent down to it for some little time, it is placed sufficiently far behind the advanced dressing station to be out of range of any but heavy artillery fire.

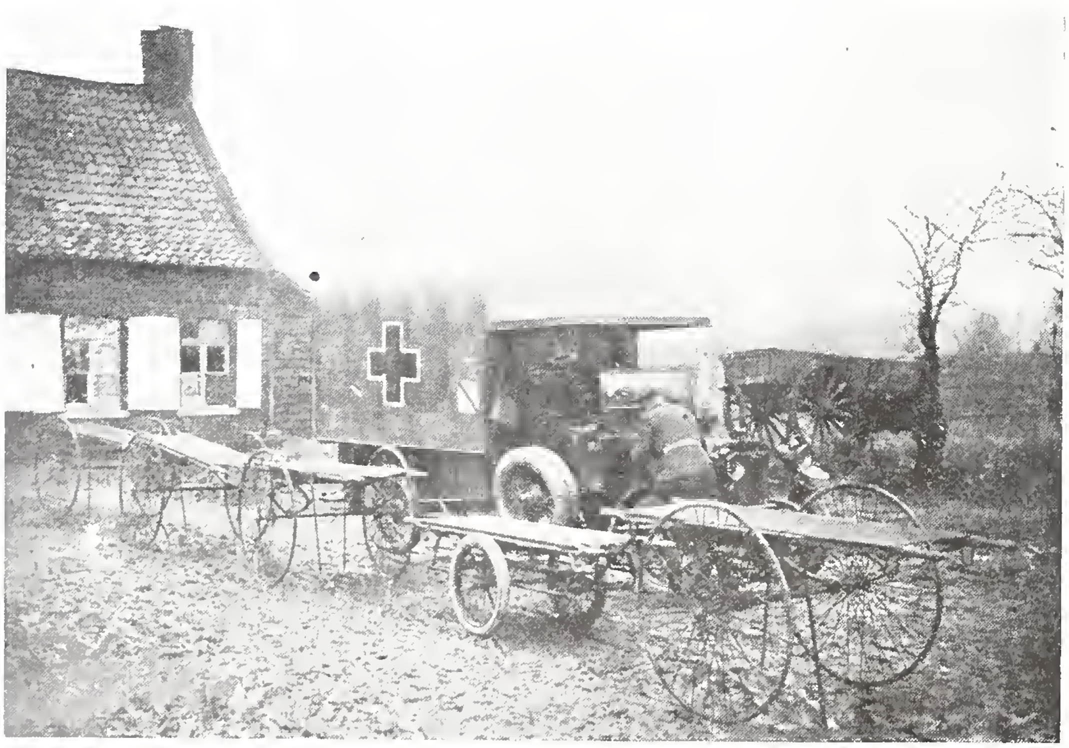
Fig. 15.—A collection of wheeled stretchers and a motor ambulance.

The exact nature of its work depends a good deal on local circumstances, including the character of the fighting in progress. Sometimes it confines itself mainly to administrative work—that is to say, to classifying the cases that arrive, and distributing them for treatment according to their requirements among subsections formed by itself or other units with which it is connected; sometimes it combines this work with actual treatment. However this may be, it always arranges to rest, dry, warm, and feed the patients that reach it, and for giving them any surgical attention they need before they can safely be sent on elsewhere. It is here, too, that all cases of wounds are examined to see that antitetanus serum has been given.

The first step is necessary because, despite the greatest possible care, the transport of a wounded man from the place where he has fallen to a place as far back as a field ambulance main dressing station must always be very trying, even if his wound be not very severe, and even if his clothes are not, as is commonly the case, soaked with rain and mud. The second step is necessary because in an advance the casualties are certain to be numbered by hundreds, and while many may not need to be sent away from the real front, operations and a period of real rest may be necessary in the cases of many others before their evacuation is possible.

Cases which require evacuation are sent to a railhead hospital or casualty clearing station, and whether their detention at a main dressing station be momentary or prolonged depends—assuming transport to be available—partly on their condition and partly on the distance to be traversed to reach a railhead hospital.

For other cases it provides sometimes by furnishing treatment itself, sometimes by sending the cases on to field ambulances or other medical units set aside for the purpose of special treatment. In every corps area, for instance, if not in every divisional area, provision is made by the field ambulances for the treatment of cases of trifling sickness and injury, or of men who are temporarily exhausted or footsore. Special arrangements are also made for the treatment, without evacuation, of more or less easily cured skin diseases, such as scabies, as also for the isolation of cases of zymotic disorder and of contacts therewith. Every army, too, has at its service centres which deal with eye cases, dental disorders, and neuroses.

The object throughout is to avoid the unnecessary evacuation of cases that can be treated at the front, for a soldier, once evacuated, is likely, however quick his recovery, to be lost to his unit for a considerable time, since any patient sent further to the rear than one of the treatment centres mentioned above ceases for the time being to belong to the army in which he had previously been serving, and cannot be restored to it except by passage through a regulated channel. Every patient evacuated from a field ambulance has what is known as a field medical card substituted for his regimental label. It contains particulars as to his name and army status, a diagnosis of his condition, and details as to whether he has received the requisite prophylactic doses of tetanus antitoxin, and any other information deemed likely to be useful to those who will subsequently treat him.

The accommodation provided for a field ambulance main dressing station varies according to the amount of work that it has to undertake, and may be anything from a village school to a collection of tents. Such accommodation as it possesses is arranged in much the same fashion as at an advanced dressing station, but everything is on a larger scale and the equipment more elaborate. It is thus in a position to undertake formal operations, though it usually limits itself to those essential to a patient's safe evacuation.

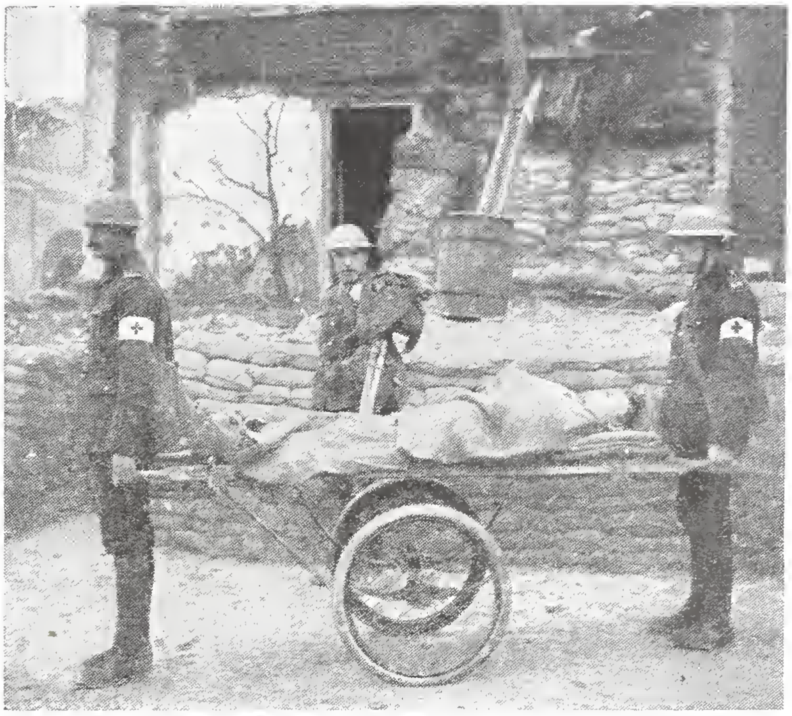
FIG. 16.—A wheeled stretcher, pneumatic tyres.

The heaviness of the work varies in proportion to that of the units further up the line. If the latter have been hard pressed, many of the cases will reach the field ambulance untouched except for their field dressings, and, even if nothing else be required, special splints may have to be substituted for improvised appliances. On such occasions each corps commonly provides itself with two main dressing stations lying close together, but working independently, one dealing with stretcher cases, the other with "walkers." The patients of the former reach it in ambulance wagons or cars, while those of the latter commonly arrive in char-à-bancs which have been sent up to meet them as far along the road towards the scene of the fighting as these vehicles can be got. This varies, for when a big action is in progress the traffic on all available roads is very heavy, a constant stream of supplies of all kinds being essential to continued fighting.

OTHER FRONT LINE WORK.

When the work of collecting and evacuating the sick and wounded is sufficient to absorb all the personnel of the field ambulances of a division or corps, any other work which they have previously been performing is assigned to those of divisions not in action, or it is provided for in some other way. The general nature of its work is indicated in the list given of the duties commonly performed by field ambulances. When bathing establishments are run as corps or army units, and sometimes even when they are run by single divisions, the arrangements always include the provision of fresh underclothing for every man who has taken a bath.

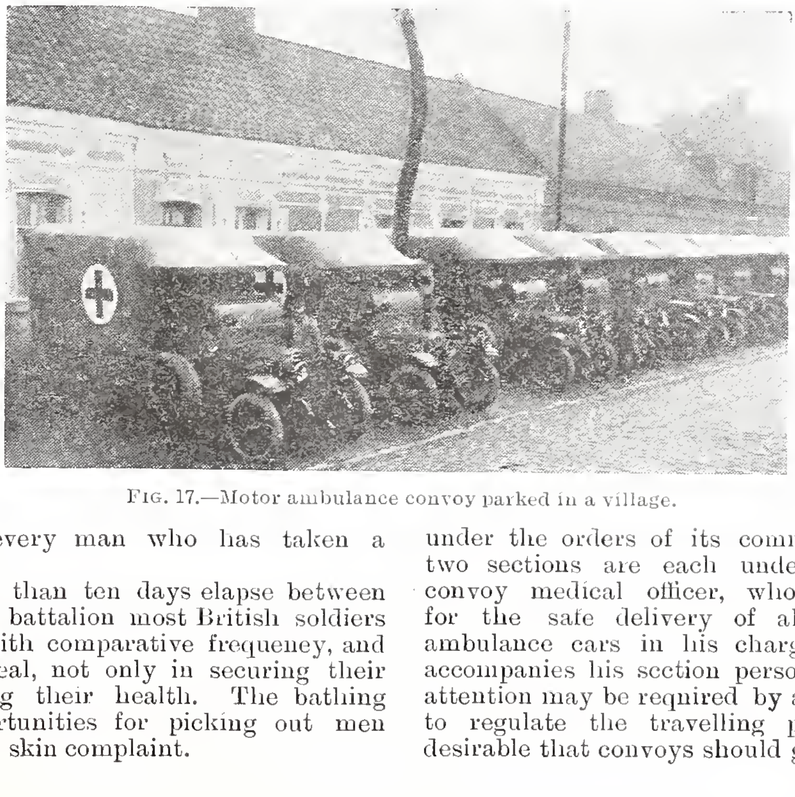
FIG. 17.—Motor ambulance convoy parked in a village.

As commonly not more than ten days elapse between the bathing parades of a battalion most British soldiers change their body linen with comparative frequency, and this counts for a good deal, not only in securing their comfort but in preserving their health. The bathing parades also afford opportunities for picking out men suffering from any form of skin complaint.

Sanitation.

The general sanitation of each army is under the supervision of an expert attached to its Director of Medical Services, while in each division there is a special sanitary section, the officer commanding it acting as sanitary expert, and advising on sanitary matters connected with the division and its component battalions and other units. Each of these sanitary sections has a small staff of non-commissioned officers and men and plenty of equipment, such as disinfecting machines, which accompany the division wherever it goes, while incinerators and the like are rapidly constructed the moment it settles down.

Battalion medical officers draw their supplies of drugs, dressings, etc., from the field ambulances connected with them, and these in their turn from the advanced dépôts of medical stores, one or more of which is to be found in every army area.

MOTOR AMBULANCE CONVOYS.

The field ambulances are responsible for the transport of sick and wounded from the advanced dressing stations to the main dressing stations, and also, but only when working in reserve or resting troop areas, for the conveyance of sick to the casualty clearing stations. The vehicles at their disposal suffice for these purposes, though it may be necessary to supplement them. Should the fighting be heavy and the casualties numerous, they are not intended to transport patients from the main dressing stations to the casualty clearing stations. This is the work of the medical transport units, called motor ambulance convoys, one of which is allotted to every army corps (Fig. 17). It also carries to the ambulance trains the evacuable patients of any advanced hospitals which do not lie immediately alongside a railway line. They are also employed, should pressure on the work of the ambulance trains be severe, in evacuating cases from the casualty clearing stations to the base hospitals by road, and sometimes to transport individual patients whose early arrival at a base is thought advisable, and who can be got there more promptly by road than if detained for the arrival of a hospital train.

Each convoy consists of fifty vehicles, usually divided into two large and one small section. The latter is commonly employed solely for train embarkation, and is then attached to one of the group of casualty clearing stations, and works under the orders of its commanding officer. The other two sections are each under the control of a motor convoy medical officer, who is personally responsible for the safe delivery of all patients loaded on the ambulance cars in his charge. Whenever possible he accompanies his section personally, not only because his attention may be required by a patient, but also in order to regulate the travelling pace. Within limits it is desirable that convoys should get over the ground quickly, and when roads are crowded by ammunition and general supply lorries, all anxious to complete their duties without loss of time, the presence of an officer with the ambulance convoy section ensures it a freer passage than it might otherwise obtain. On the other hand, there may be certain patients for whom a slow travelling pace is desirable throughout, unless the surface of the roads prove excellent—a matter about which there is always uncertainty.

Each motor ambulance car can carry six or eight patients sitting up, or four lying down. To neutralize the tendency to shock exhibited by so many wounded men the vehicles are now generally heated automatically by the exhausts (Fig. 18), and are also provided with hot-water bottles.

The motor ambulance convoys are an outcome of the circumstances of the war in France, and an example of the ingenuity of the Royal Army Medical Corps in promptly adapting its arrangements to the needs from time to time arising. Before the war the Royal Army Medical Corps, in common with the medical services of the armies of all other countries, had to depend for the transport of casualties between advanced formations such as field ambulances, and rearward units such as railhead hospitals, on the use of supply wagons going back empty to the rear. It was the only arrangement feasible at the time, and though admittedly far from ideal, was suitable enough for the small wars in more or less uncivilized countries to which Great Britain had been accustomed, and not involving any very large number of casualties.

The experience, however, of a few engagements at the beginning of the war showed the Director of Medical Services of the original Expeditionary Force (Sir T. Woodhouse) that the means in question would not suffice for his needs, while at the same time he found that, in the removal of patients capable of sitting up, ordinary touring cars, of which offers were made to him by various French and other residents in Paris, could be of real assistance. After some of these had been fitted with bodies very like those now used in all motor ambulance work, and others had been sent out from home, he arranged two experimental convoys, which began to work between the Aisne and Paris in the first days of October, 1914. This experiment having proved that motor ambulances could be used with safety for long, rapid transport and over cobbled roads, and not only for short journeys in cities and suburbs, as had previously been supposed, the Director-General of Medical Services (Sir Arthur Sloggett) on his arrival in France at the end of October decided to adopt motor ambulance convoys as a definite component of the arrangements of the Royal Army Medical Corps in France. It was a decision of whose wisdom convincing evidence was quickly forthcoming.

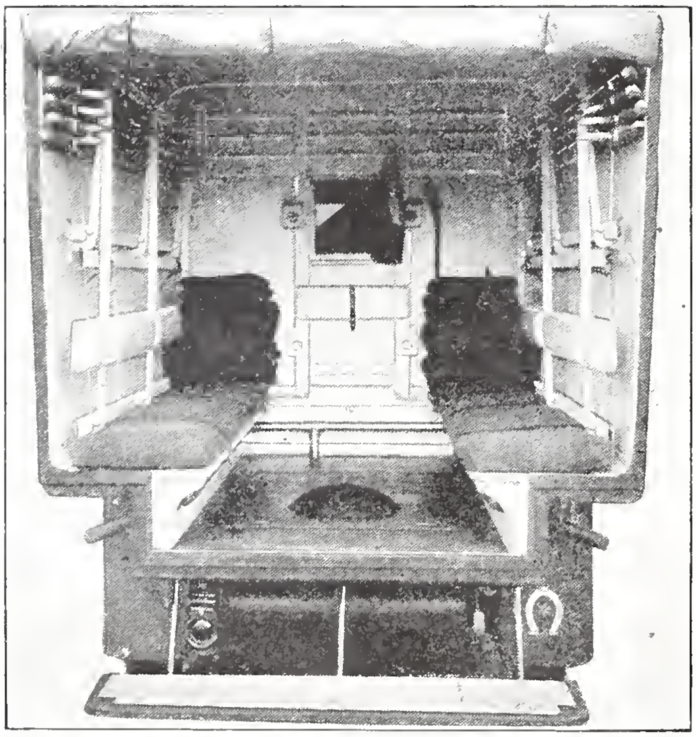

FIG. 18.—Interior of ambulance car heated by hot-air pipe from exhaust.

CASUALTY CLEARING STATIONS.

The railhead hospital or casualty clearing station may theoretically be described in several ways.

1. As the administrative junction between the lower limit of the collecting zone or front with the upper limit of the evacuating zone or lines of communications.
2. As the focal point to which converge all roads leading from the front, and from which diverge all roads leading to the base.
3. As the spot where road transport ends and railway or analogous transport begins.
4. As the place where all casualties collected from main dressing stations are deposited until the moment comes for their transport through the evacuating zone to the base or distributing zone.

In practice the casualty clearing stations justify all four definitions more or less precisely, but the fact is rather obscured by their multiplicity and the great length of the front. It will be found, however, that whatever may be the position of a given casualty clearing station there are always roads that lead to it from the front, and that, however far beyond the general level of the evacuating zone it may seem to lie, it preserves its theoretical relation thereto, because a tongue or spur has been thrust up to meet it.

SELECTION OF SITE.

Two of the essentials in the selection of a site for a casualty clearing station are ready access from the front for motor convoys and free communication with the base by ambulance trains. A third is plenty of room for the necessary tents or huts, a free water supply, and safety from any but extreme range artillery fire. To find a suitable site is often difficult. Adequate room and protection from artillery fire are generally easy to secure, and water can be piped from a considerable distance, but to find a place which, besides being suitable in other respects, is readily accessible by road from the main dressing stations concerned, and lends itself to evacuation to the base by train, is much more difficult. It is a problem, in fact, which can often be solved only by running a special branch railway up to the proposed site, or by choosing a site which is on an existing railway but at a considerable distance from the main dressing stations that have to be cleared.

The first plan involves heavy expenditure of time and labour, and is usually adopted only when later on the site may be useful for some other purpose, or when the branch line can be made to serve more than one end.

The second solution is therefore the commoner, but it is to be remembered that accessibility and shortness of distance as the crow flies are not interchangeable terms. The old proverb, "The longest way round is the shortest way home," has a particular application to the transport of wounded men. Once a man is in a well-sprung pneumatic-tyred ambulance car the exact distance that he travels is of less importance than the character of the roads over which he is borne. Hence, independently of all other considerations, a site which communicates with the front by good roads is always to be preferred, even if the distance to be traversed be treble, to one which can be reached only by lanes and cart-tracks.

This is one reason why the casualty clearing stations as a whole are distributed irregularly in regard to their distance from the main dressing stations they serve. The same reason also helps to account for the differences in the habitations of casualty clearing stations. Some are in permanent buildings in towns or villages, some in huts far away from all other buildings; others in huts and tent-marquees, others in tent-marquees alone. The completely tented casualty clearing stations are usually found to be in the new parts of the line. As they settle down they acquire huts for operating theatres and administrative purposes, and if, later on, when the line moves forward, the sites that they occupy are likely to prove suitable for stationary hospitals, all the tents are replaced by huts.

THE FUNCTIONS OF A CASUALTY CLEARING STATION.

A casualty clearing station is in principle a mobile unit, since it must always keep within reasonable distance of the main dressing stations; and therefore be prepared to move when these are moved, in conformity with any change in the tactical situation of the troops they serve. Primarily it is an evacuating unit, and only intended to act as a hospital so long as it is forced by circumstances to retain its patients, and it was probably in order to keep its status well in the foreground that not long after the war began the title "casualty clearing station" was substituted for the original term "clearing hospital." For a corresponding reason every casualty clearing station is provided with three lorries of sufficient size to transport at a moment's notice all the equipment that strictly speaking it is entitled to possess.

But however thoroughly casualty clearing stations may justify the suggestion of their title, they always go a good deal beyond it; for their functions and personnel have been adapted to existing circumstances by the D.G.M.S. in France. Hence they are no longer mere stations but real hospitals, despite the fact that some are only about six miles from the fighting line, and few lie further off than double that distance. The patients are nursed by trained women nurses; ordinary hospital beds are provided for the more serious cases; the operating theatres have usually four operating tables, are equipped with electric light, and the appliances familiar in the hospitals of large towns; and while some have *x*-ray annexes of their own, all have at their command the services of travelling *x*-ray outfits, and clinical laboratory work is done for them by the mobile laboratories which are commonly to be found in their neighbourhood.

When a casualty clearing station has been established for some little time, the chief differences between it and a base hospital are attributable to the diversity of duties that the casualty clearing station has to fulfil. In addition to acting as a true hospital for a short or long period, it must always be ready to operate on a very large number of patients, and to evacuate forthwith those that can safely be moved, and must also be able rapidly to prepare for immediate evacuation a very much larger number of slight cases. It must also be ready suddenly to receive and accommodate in one fashion or another an almost unlimited number of sick and wounded. Consequently, in addition to whatever accommodation in the way of actual beds it may possess, it must provide also:

1. Tents in which men lying on stretchers can be kept under cover, and receive what they require in the way of food, warmth, and surgical attention.
2. Accommodation for classifying the cases that arrive according to whether they must undergo operations under an anaesthetic, or merely require some such attention as the redressing of a wound or the replacing of a splint.
3. Accommodation for men who have received all the attentions they need, and are merely waiting to be loaded on the train.
4. Accommodation for the performance of minor surgery.

THE WORKING OF A CASUALTY CLEARING STATION.

There are considerable differences in the way different casualty clearing stations meet these needs, but in regard to definite operations the general practice is to provide sufficient accommodation and personnel for the performance of at least four operations simultaneously and continuously for an unlimited number of hours or days. Even when a battle is in progress, of the wounded men who arrive at the casualty clearing station at least 10 per cent. must visit the operating theatre before they can be sent to the base hospitals.

In regard to other matters the general procedure is usually as follows: As soon as a convoy arrives the patients are all off-loaded promptly so that the ambulance shall not be detained. They are carried into a distributing room, where, while a clerk takes down particulars of his army status, etc., a medical officer decides to what class of case each patient belongs, being guided in this matter partly by his condition, partly by what is stated on his field medical card.

Thus, for instance, A, who has an abdominal wound, is sent straight to the operation-theatre preparation room. So, too, is B, who has a wound of the head and is insensible. C, who has a wound of the thigh, is sent to the stretcher case dressing-room; but D, who has an apparently corresponding wound, is for some reason in a state of profound collapse, and is therefore sent to the observation ward. E has a perforating wound of the upper thorax, and is sent to the chest ward; while F, who has a flesh wound of the shoulder, is sent to the walking case dressing-room.

When A arrives in the preparation room all his clothes are removed, and he is got ready for a laparotomy, which takes place as soon as a table in the theatre is free. B, in addition to other preparations, has his head shaved, and is sent to the theatre as soon as a surgeon and anaesthetist are ready for him. It may be decided that no craniotomy should be performed, at all events until the patient has reached a base hospital, but the case must be thoroughly examined before this conclusion is reached.

C's stretcher is placed on trestles and his wound carefully examined to see whether any operation is required; if so, he too is sent to the operation-theatre preparation room; otherwise his wound is redressed and an extension or other splint suitable for train travelling is applied. D, on his arrival in the observation ward, is put to bed and submitted to various antishock measures until his condition is sufficiently good for an elaborate treatment of his wound. E, on his arrival in the chest ward, is examined by a medical officer who specializes in internal medicine.

When F enters the walking-case room his bandages are taken off and the required treatment applied, unless his general condition and his field medical card clearly indicate that no further interference with the wound is likely to be desirable until he reaches a base hospital. From the dressing tent for walking cases F goes to the evacuation tent for walking cases, where he is given food and cigarettes and waits for the ambulance train; a train is usually available every day, and even oftener in times of activity; but, if there is any delay, F is given a stretcher bed and his wound is redressed in due course.

Meantime, into another evacuation tent men who belong to the various classes, A, B, C, D, E, and who have come down with the same or a previous convoy, are being brought on stretchers from the wards or other places where they have been prepared for evacuation. The standing regulation is to send on all cases to the base as soon as suitable transport is available, but any case at all likely to suffer by transport is detained as a matter of course; chest cases are never sent down until all danger of haemorrhage is presumed to have ceased, and abdominal cases are detained until they have so far recovered that they can be sent straight through to Great Britain without further treatment at the overseas base.

In any case the number of men detained is usually quite sufficient to afford the personnel plenty of ordinary hospital work between the arrival of convoys, and in order to secure time for its due performance, even when fighting is heavy in the part of the line served by the casualty clearing station and casualties are numerous, every casualty clearing station has a partner located at the same rail-head, and the two are alternately "open" and "closed" for the reception of patients. When times are quiet the commonest plan is for the casualty clearing stations concerned to open and close on alternate days. During active fighting a casualty clearing station usually declares itself "closed" when it has a given number of unevacuated patients on its hands; its partner then takes the next convoys. Should it happen that the partners are both "closed," the D.M.S. of the army concerned sends later convoys to the casualty clearing stations of some other area under his command.

Specialist Surgeons.

As a convoy does not represent a specific number of patients, and the number of convoys dispatched from any main dressing station in any twenty-four hours depends entirely upon the state of the fighting, the amount of work thrown upon a casualty clearing station varies greatly from time to time. Sometimes it resembles that of an ordinary hospital in a manufacturing town where accidents are frequent; sometimes that of a main dressing station of so elaborate a type as to be able to perform both aseptic and septic operations, and so large as to be able to deal with 1,000 or more patients a day. Its permanent staff consists of seven medical officers, but when the fighting is heavy it is reinforced by medical officers drawn from casualty clearing stations, field ambulances, or other medical units in other parts of the line. On its permanent staff are always at least two surgeons experienced in all classes of operative work, including abdominal surgery, and the reinforcements sent when times are active include other surgeons of the same type. The net result, therefore, is that by arranging in groups the total number of surgeons and anaesthetists available, the necessary operations can be performed until the stress is over.

Distribution of Patients.

When the convoys are not large and not arriving in rapid succession, the work of distribution is done by the orderly medical officer on duty; at other times it is usual to select a surgeon of wide experience for the work, since the duty of the "spotting officer" then becomes a task of great responsibility. He must be able, for instance, to gauge rapidly the general condition of a patient and the probable degree of seriousness of his wound. In addition to bearing in mind continually how long it is likely to be before an ambulance train arrives to clear the hospital, he must keep a constant eye on the operation list. Should the latter be comparatively short or the stream of patients be falling off, his task becomes relatively easy, since he can mark for the preparation room any cases which seem at all serious. In the contrary case, he must decide whether the individual and general interests would best be consulted by sending the case down to the base forthwith, should an ambulance train be waiting or expected shortly to arrive, or by keeping him, even though it is not likely to be possible to perform the operation for many hours.

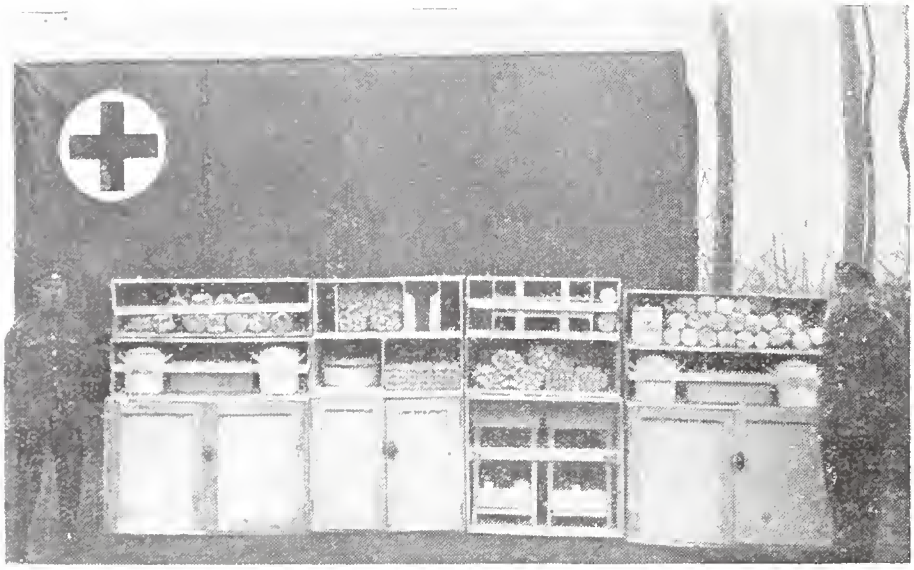

FIG. 19.—Trailer with one half of its equipment unloaded. The cupboard most to the spectator's left is for dressings, the next for instruments, the next contains two anaesthetic tables, and the cupboard most to the right has three compartments for splints—long splints, thigh, short splints, arm, and leg splints respectively. The shelves above the cupboards show the method of packing dressings, etc.

Consulting Surgeons.

The clinical work of the casualty clearing stations in each army is under the supervision of an officer who in peace times is a well-known consulting surgeon, and corresponding supervision is exercised in respect of medical conditions by a physician of analogous experience.

Before being evacuated from a casualty clearing station a note is added to the field medical card of every patient as to the treatment he has received, and if an operation has been performed, or he has been detained as an ordinary hospital patient, clinical notes concerning his case for the information of the medical officers at the base are sent on in an envelope attached to a button of his bed jacket.

Many casualty clearing stations also do a certain amount of work in attending to local sick—that is to say, to cases amongst labour parties and other troops in their neighbourhood which are not in charge of a medical officer or within the area of the work of a field ambulance. It is also the rule for a casualty clearing station to detail a medical officer to afford medical attention to members of the civil population if a request to this effect is made by the local civil authority.

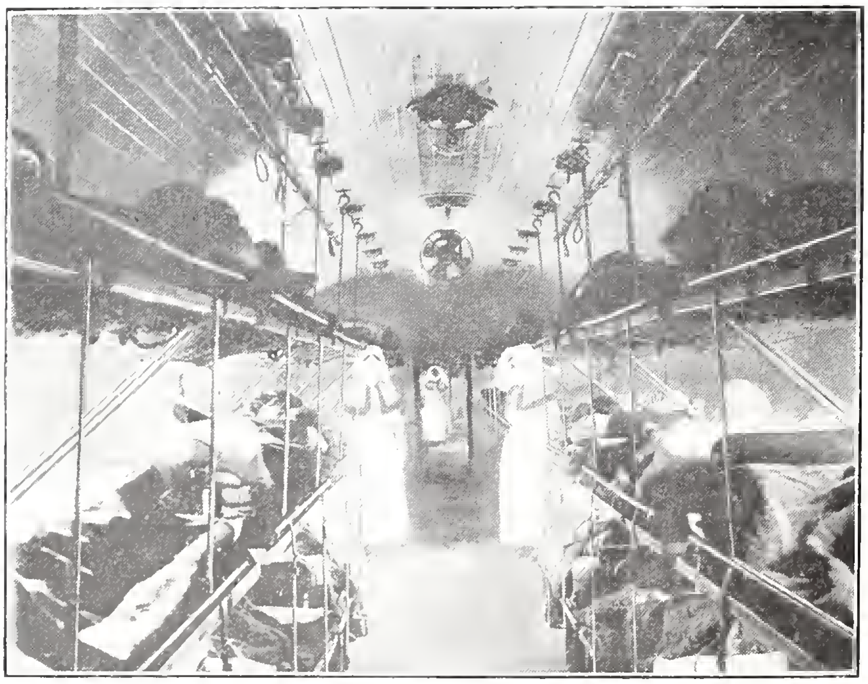

FIG. 20.—Interior of a hospital train; the majority of lying cases are evacuated by ambulance train.

THE THEATRE TRAILER.

Though a casualty clearing station is a mobile unit, the transfer of so large an institution from one site to another takes a considerable time. In an advance it may be desirable to push an operating section forward at once. To meet this need the "theatre trailer" has been devised. It consists of a large pitch-pine framework, which can be clamped on to a trailer drawn by one of the lorries of the casualty clearing station. The lorry is loaded with stretchers, blankets, cooking and feeding requisites for a hundred serious surgical cases for two days, and carries also a hospital marquee and operating tent. The original idea for the trailer, as suggested by Colonel Cuthbert Wallace in September, 1916, was to fit it with shelves and pigeon-holes, as on a ship. After further study, however, it was seen that it would be better to make the cupboards and other fittings movable, providing for the careful packing of their contents so that they would not suffer on the road. Each cupboard runs on four wheels, and is fitted to hold and carry without damage dressings, instruments, bowls, and enamel ware, as well as the Bowlby outfit and the marmites in use in almost every casualty clearing station theatre. There are two cupboards for sterilized dressings, overalls and towels, sufficient for one day's operating, with two surgeons and four tables, dealing with 150 major operations. In addition, six complete sterilizing drums are carried, and in all sufficient dressings for 500 operations. Lotions, made up in quart bottles, are packed in a specially designed case fitted in one of the shelves. Boiled water and saline are taken in sterilized petrol tins. The instruments are packed in webbing straps stitched together and attached to the shelves. Three anaesthetic tables and folding stools are packed into two cases, which, when unpacked, can be used as surgeons' washing-up benches. The bottom shelf of each anaesthetic table contains nine compartments, each of which holds a two-pound bottle of chloroform or ether. Two other shelves contain the anaesthetic apparatus, masks, gauze, etc. Other cupboards contain primus stoves and their fuel, cleaning materials, a rack for splints, and a stand for the lotion copper cauldrons. The shelves fit one above the other, and can be built up in any order that may be desired to form dressers or small cupboards. The contents of one side lifted out of the trailer are shown in the illustration (Fig. 19). With the trailer and trolley are four R.A.M.C. orderlies, and there are two Army Service drivers. These six men can pack the loaded furniture into the trailer in ten minutes. The main advantages of this trailer, the details of which have been worked out by Captain E. M. Cowell, R.A.M.C.,[1] and Lieutenant-Colonel G. H. Goddard, R.A.M.C., are that it ensures the careful transport of the delicate equipment of an operating theatre and provides operating room furniture ready for immediate use in all circumstances.

AMBULANCE TRAINS AND HOSPITAL BARGES.

A patient may be sent down through the evacuating zone to the base either by ambulance train, by hospital barge, or by motor convoy; in the great majority of cases the first is the method employed.

Ambulance Trains.

Several types have been used since the war began. In the early days the predominant type was made up mainly of goods vans fitted with racks to support stretchers, and supplemented by straw-strewn vans for the more lightly wounded. These trains were effective so far as actual transport was concerned, and were easy to load and unload, since the doors were wide; but the carriages could not be lighted easily or kept warm, they afforded no conveniences for administrative work, and it was very difficult for the medical officers to attend to their patients once the train had started. Moreover, unless the vans were drawn from passenger trains, and this was comparatively rare, they were mounted on four wheels only, had very ineffective springs, and practically no brakes. They were gradually displaced by trains built up of ordinary passenger coaches supplemented by a saloon or restaurant car for administrative purposes. The compartments were so arranged that they could each contain four stretcher cases lying at right angles to the line of travel. Most of the coaches thus used had six wheels, and were much better sprung and braked than goods vans. They were also much better lighted, and, as a rule, each vehicle had a firebox attached exteriorly, and thus had independent heating. On the other hand, loading and unloading was not easy, since the doors were narrow, and only rarely was it possible to arrange for intercommunication between all the carriages, so that some of them could be visited only by walking along the foot-board or by stopping the train.

A few trains of this type are still in use, but the majority belong to a third type, which is built up partly of corridor car "coaches" for patients able to sit up, partly of specially constructed "ward" carriages (Fig. 20), intercommunicating cars with tiers of berths down each side and a passage way between them. These berths are open at the ends, and have both wire and ordinary mattresses and blankets and sheets, and the patients are habitually put to bed in them, unless for some reason, such as the existence of an injury to the spinal column, it is desired to avoid moving a patient off his stretcher. In such cases the stretcher is laid on the top of the bed. These tiers of beds are arranged parallel to the line of travel, and as there are six sets of tiers on either side and each consists of three berths, the normal accommodation of a travelling ward is thirty-six patients, while if occasion requires, it can be increased to forty by laying stretchers in the passage way between the tiers.

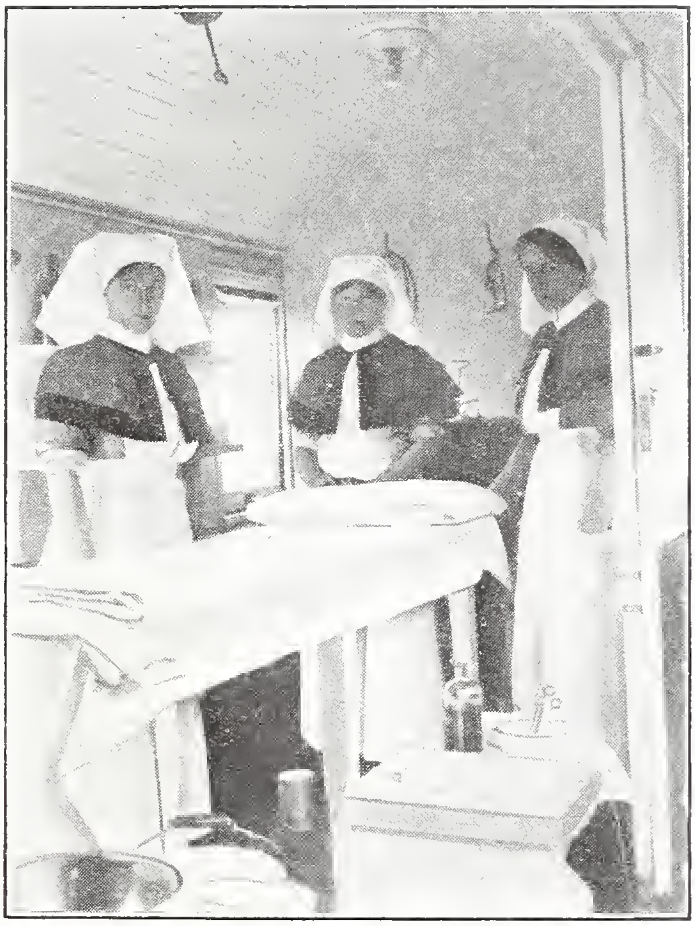

Fig. 21.—The operating theatre of an ambulance train.

The usual plan is to place the carriages in the following order, working from the engine backwards: A carriage used as an isolation ward; a coach with its compartments arranged as sleeping quarters for the medical and nursing staff; a kitchen coach; four or five ward carriages; an administrative carriage, providing an office, a room for the performance of operations (Fig. 21), and a dispensary; four or five coaches for sitting-up patients; a carriage for general cooking purposes; a coach to serve as sleeping quarters for the subordinate personnel; a van for stores; and a guard's van. About 400 patients is an average load for such a train.

The "ward" carriages have wide external as well as internal doors, so that they are easy to load and unload, and the train is electrically lighted and steam heated from end to end. The wide doors of communication between the carriages afford a vista of half a dozen carriages in succession, and the actual passage way extends from one end of the train to the other. All the ward carriages, moreover, are mounted on well-sprung eight-wheeled chassis, and a Westinghouse compressed air automatic brake operates from end to end of the train. The net result is that they are easy to work and run smoothly even over the much-used permanent ways of Northern France.

All the advantages of these trains are attained likewise in a fourth type, which is the latest to come into use. In it the accommodation for patients consists entirely of ward carriages, wherein as much provision for sitting-up patients as may be required is made by turning up the middle berths of the tiers, thus leaving the upper berth for a lying-down case, while the lower one forms a sofa for three or four sitting-up patients. In the third type of train the sitting accommodation in the coaches often proves to be in excess of the requirements, so that the fourth type represents economy in engine power and rolling-stock, since, whatever the proportion of lying-down cases to sitting-up cases, the whole of the accommodation can be utilized.

Ambulance trains so long as they are loaded are managed very much as if they were ordinary hospitals, but there is not usually very much dressing to do unless in a considerable proportion of the cases irrigation treatment is being applied. There are always, however, patients who require attention, and for the first hour or so, at any rate, after the train has been loaded the whole of the staff is kept busy. Once they have settled down the majority of patients sleep peacefully to the end of their journey, even those who are travelling in sitting-up coaches. They have left the battlefield behind them; they have had their wounds dressed, and all tension is at an end. This restfulness of an ambulance train, despite many physical reasons to the contrary, was noted long before the prevailing type of train came into use, and is one of the more curious psychological features of the war.

For an ambulance train of the second type the allowance of medical officers is usually three, but for the third and fourth types only two are generally required; in each case three or four sisters are carried in addition to nursing and general-duty orderlies, cooks, etc. Unless a journey is unusually long, the majority of the staff remains on duty during the time the train is loaded. As soon as the patients have been unloaded the whole train has to be cleaned, bed-linen changed, dirty linen dispatched to the wash, and fresh supplies of stores obtained, so that rest for an ambulance train staff does not come until the up-country journey has commenced.

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[1] A full account of the Wallace-Cowell trailer, with details of construction and stores, will be found in the *Journal of the Royal Army Medical Corps* for June, 1917.

The movements of the trains as a whole are regulated by a medical officer of the staff of the D.M.S. Lines of Communication. If a full load is not waiting at any single rail-head, several are visited in succession. Once loaded, the train travels at a rate of about twelve miles an hour to its destination at the base, which may be anything from fifty to a hundred miles away. Information as to the hour of its probable arrival is telegraphed to an officer at its destination, who meets the train with a sufficient number of stretcher-bearers and motor ambulance cars to distribute the patients promptly among the various hospitals at this base.

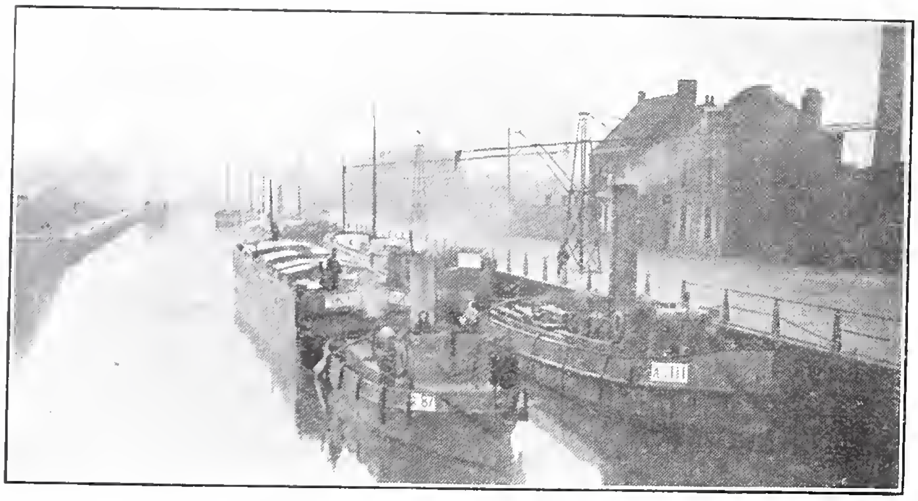

Fig. 22.—Hospital barge being towed.

Hospital Barges.

Evacuation by hospital barges is necessarily restricted to parts of the front traversed by navigable canals, and also by the fact that comparatively few casualty clearing stations lie sufficiently near canals for patients to be embarked without an intermediate journey in an ambulance car. This means of evacuation is slow, but is of use in dealing with patients for whom it is desired to secure absolute freedom from shaking. Barges, however, are not used solely for evacuating purposes; in certain parts of the line they can be taken close up to main dressing stations and advanced operating stations, and can then be used either to provide additional accommodation or practically as if they were travelling casualty clearing stations, chest cases and abdominal cases being placed straight on board after operation and taken down to a port, where they are evacuated to a home base by being loaded on a hospital ship.

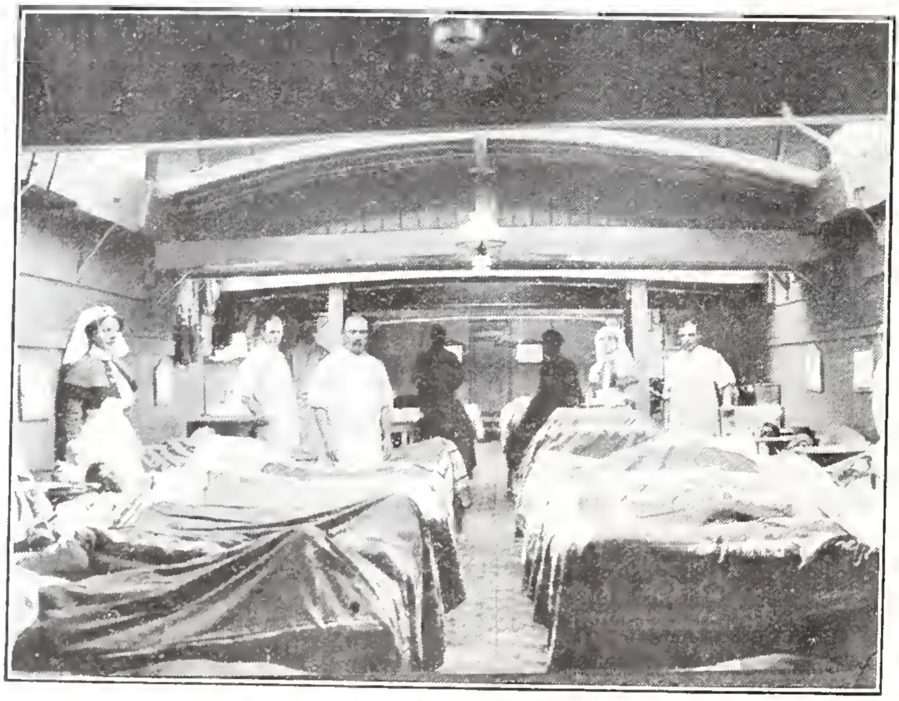

Fig. 23.—Interior of a barge full of wounded.

The barges used are those familiar on Flemish canals (Fig. 22). When one end of the interior has been partitioned off into cabins for the staff, and the other into a kitchen, scullery, and quarters for the subordinate personnel, there remains ample room in the middle for thirty ordinary hospital beds arranged fifteen on each side with a passage between them. There a space amidships into which patients are lowered from the deck above by means of a hand lift. This space can be used for the performance of operations if necessary. Except that its ceiling is low (about 10 ft.) and its diameter comparatively narrow (about 16 ft.), a barge ward looks very much like a hospital ward (Fig. 23).

All the barges are provided with a dynamo and gas engine; they can be lighted either by electricity or by removing one or more sections of the deck which forms the ceiling of the ward. They are drawn by a tug in charge of men accustomed to canal work. They are divided into flotillas of four, but more often than not they travel singly or in couples. Every barge carries two trained women nurses in addition to nursing orderlies, general orderlies, and cooks. Each barge also carries a medical officer, unless two barges or more are travelling together, and then one is sufficient for all of them. The average duration of a barge journey is from twenty-four to forty-eight hours. They travel only by daylight, and at the rate of about three miles an hour.

STATIONARY HOSPITALS.

At places along the railways traversing the evacuating zone there are medical units known as stationary hospitals. These in theory are 200-bed hospitals of comparatively simple equipment as compared with that of a general hospital. Their bedsteads, for instance, are folding iron "barrack bedsteads," and they are not supposed to have clinical laboratories or *x*-ray annexes. In France, however, nearly all stationary hospitals are capable of accommodating several times their regulation number of patients, and many in point of equipment and extent of accommodation do not differ from the large general hospitals in the distributing zone, unless they are used to fulfil some special aim.

Such of these units as are in the evacuating zone do their work in direct association with main dressing stations, and since the dispatch of a patient to them does not necessarily entail his formal evacuation, they are almost to be regarded as annexes thereto and therefore as front-line units. The rest are used for the reception and treatment of cases of sickness and injury among troops on the lines of communication, and for cases which the medical officers in charge of ambulance trains may think it desirable to off-load at the earliest possible moment. Strictly speaking, a stationary hospital is not entitled to more than seven medical officers, but it is allotted a larger number if it accommodates more than its regulation number of patients, and is doing work which for its due performance requires an augmentation of the staff.

CONTROL.

It is from general head quarters that the Director-General of Medical Services usually controls the whole of the medical work of the front through the Directors of Medical Services of the different armies, as also that of the evacuating zone and the distributing zone through the Director of Medical Services Lines of Communication.

The operations thus controlled include not only the disposition and maintenance of hospitals and other medical units, together with all the arrangements for the evacuation of patients from the front to the bases and from the bases to the United Kingdom, but also certain other important branches of work. These are the distribution of medical reinforcements, the co-ordination of action throughout the whole British force in regard to sanitation and the prevention of epidemic disease, and the work of weeding out from the armies men who, though still useful soldiers, are not capable of doing front-line work, many of whom must eventually be sent home to be discharged from the army.

At the same place are also held the periodic meetings of a council formed by the Director-General of Medical Services to assist him in the settlement of questions from time to time arising. It consists of eight members and is so constituted that the temporary and permanent elements of the medical service of the army, general and bacteriological hygiene, medical and surgical work at the front, the same work at the bases, and administration throughout the whole area, are all represented in equal proportions.

There is a second council of the same general kind, which includes the whole of the civilian consultant specialists holding temporary commissions in the army, as well as the principal permanent officers on the staff of the Director-General of Medical Services. But this meets less often owing to the difficulty of withdrawing so many officers from their ordinary work simultaneously.

THE DISTRIBUTING ZONE.

The hospitals to which the patients are sent on their arrival in the distributing zone are known as general and stationary hospitals. The former are in theory much larger and more comprehensively equipped than the latter. In practice, however, there is in France often no difference even in point of size, and invariably both afford the same facilities for the best forms of medical and surgical work. That is to say, their ward equipment is of the same kind as in large civil hospitals in times of peace, they have all large and elaborate operating theatres and annexes, and bacteriological laboratories and x-ray annexes.

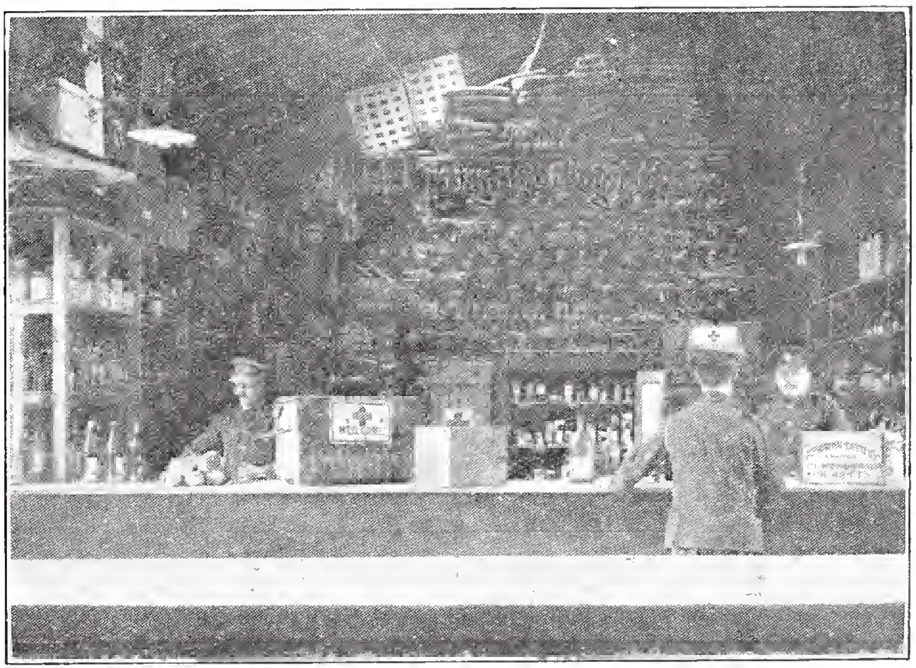

FIG. 24.—A store for an ambulance train.

Organization of General and Stationary Hospitals.

In point of size every stationary hospital can now accommodate at least 500 patients instead of the regulation 200, and every general hospital at least 1,040 instead of 520. The larger figures represent the number of beds kept at all times ready for the reception of patients. In time of pressure the accommodation can be increased by some 50 per cent. The clinical work is divided into a medical and a surgical division, each in charge of a specialist assisted by ward medical officers. To the surgical division there are also attached specialists in operative surgery who vary in number according to the accommodation of the hospital.

The nursing is done by trained women, those appointed to each ward working under the supervision of a ward sister, who is subject in her turn to the hospital matron. There are also a certain number of orderlies trained in nursing duties, who assist and on occasion replace the women nurses, and of general duty orderlies who do all the rough work of the hospital. The male personnel is under the control of a non-commissioned officer commonly called a wardmaster, who is subject in his turn to the sergeant-major of the hospital. Supplies of every kind are obtained by the quartermaster, who is responsible for their due preparation. He holds honorary rank as an officer in the Royal Army Medical Corps, and to attain this position he must not only possess tact and good manners but must pass examinations in general education and technical and military subjects spread over so many years that most quartermasters are men who have entered the corps at a very early age.

The laboratory and x-ray rooms are in the charge of specialists, privates or non-commissioned officers who have received training in these duties being appointed to assist them. The institution as a whole does its work under the control of an officer of the rank of lieutenant-colonel or colonel, who in the larger hospitals has a registrar to assist him in the keeping of medical records. In times of pressure this officer commonly takes charge of a certain number of beds, and often also acts as company officer or adjutant, his work including disciplinary control of the more military side of the work of the unit.

A few hospitals occupy large buildings, such as casinos or hotels, but most of them now lie in camps outside the towns, of which they nominally form part. They are formed sometimes of huts alone, sometimes of huts and marquees. The marquees have boarded floors, stoves, and electric lighting and double roofs. In fine weather the whole of one side of a marquee can be removed, the patients being thus kept practically in the open air; the marquees can also be placed end to end, a continuous ward capable of holding perhaps a hundred beds being thus formed. The hospitals at bases are rarely moved, so that not only are the camps they form irreproachable in the matter of sanitation, but they are almost invariably attractive likewise in other ways, as there is much rivalry among the staffs of different hospitals, and neat paths, shrubs, and flower beds spring into existence with great rapidity.

But, although base hospitals are well equipped and managed on identical principles, they are differentiated to some extent by the character of their work. At each base, for instance, one hospital deals solely with infectious diseases, while the rest, though prepared to take cases of all kinds, habitually specialize in the treatment of some particular class of injury or disease—for example, skin disorders, ophthalmic troubles, jaw injuries, nerve complaints, head cases, and fractures of the lower extremities. There are also some base hospitals which, owing to their distance from evacuation points, deal mainly with comparatively light cases.

At all base hospitals the time for which serious cases may be retained is not limited, but the general rule is to transfer to Great Britain any cases which are deemed fit for transport and are not likely to be fit for active service again in less than three weeks. Patients who complete their treatment in the base hospitals are sent on their discharge to convalescent dépôts, where they remain for a varying number of days, and thereafter, if considered fit once more for the front, are sent to the dépôts of the regiment or corps to which they belong. In the contrary case they are marked as base details and are kept under medical observation in barracks and employed on duties of various kinds

Base Medical Store Dépôts.

Other medical establishments at the base are dépôts of base medical stores (Fig. 24), whence all the up-country dépôts, as well as the local hospitals and ambulance trains, draw their supplies, and the base hygiene laboratories, whose main work is to test the purity of the food supplies of the troops. There is also at one base a large bacteriological laboratory devoted solely to research work, and much work of the same kind also goes on at the laboratories attached to the different hospitals. Sometimes the work is done as an independent effort, sometimes in co-operation with the officers in charge of the mobile laboratories in the collecting zone, and as a means of testing how far the results there obtained are supported by observations made on patients who have reached a later stage of their illness or injury.

Laboratories: Medical History.

The general control of all the laboratories and of their work in the investigation of the problems of epidemic disease is the special charge of an Adviser in Pathology to the Director-General of Medical Services. In addition two officers appointed by the Director-General represent the Medical Research Committee of Great Britain; their duty is to advise upon the systematic recording of clinical notes, so that the requisite data may be available for general medical statistics and for pension claims, and also to secure that the various new types of disease and injury seen in this war are made the subject of specific study from a clinical and a pathological point of view by selected officers. As comparatively few cases remain in the hospitals in France throughout their whole course, the work involves securing continuance of study of many of the cases on their arrival at home. The aim in view is to secure that all the data necessary for the formation hereafter of sound opinions as to the medical lessons of this war shall be duly forthcoming.

As in the various army areas, the clinical work at each base is supervised by consulting specialists in various branches of medicine and surgery, and dissemination of newly acquired knowledge is secured partly by memorandums issued from time to time by the Director-General of Medical Services, partly by meetings of medical societies established not only at the bases but in the collecting zone, and partly by publication of results in the medical press.

The base hospitals are also used as dépôts for medical reinforcements, officers newly arrived from home being appointed to them, both in order that they may gain some experience of general routine, and also to enable the authorities to ascertain their physical and other aptitudes for work of various orders. The younger men are sent eventually to field ambulances and thence to regiments.

Overseas Contingents.

All the great British dominions beyond the seas—India Australia, New Zealand, Canada, and South Africa—have medical units in the field, though they are all worked on the same system as units which are strictly speaking Royal Army Medical Corps units, and they are all under the control of the Director-General of Medical Services. An account of one of these—the Canadian Army Medical Corps—written by Surgeon-General Fotheringham of that corps, will be published in an early issue. There have been one or two hospitals officered entirely by volunteers supplied by the faculties of certain universities in the United States of America, and some units working under the aegis of the British Red Cross Society. These also have been under the general control of the Director-General of the British Medical Service.

General Administration.

In most of the military hospitals in France the administrative work is done by permanent officers of the Royal Army Medical Corps, and the bulk of the executive work by temporary officers, who contract to serve for the year, but in most cases renew their contracts as a matter of course. For the first eighteen months or more all these officers were volunteers, but since all men under 41 are now liable for military service, a considerable proportion of those now arriving are selected by civilian Medical War Committees, in response to the demands of the War Office. In making the selection the committees have regard not only to the fitness of the individual for foreign service, but also to the question of his indispensability or otherwise from the point of view of the civil population among which he has been practising.

Intermediate between these two orders come a certain number of officers who have received commissions for the duration of the war, and who are usually doing special work of some kind, and a large number of Territorial and Special Reserve officers. The former are civilian medical practitioners who long before the war joined the volunteer body known as the Territorial Army as medical officers, and by taking part in annual exercises and in other ways acquired a general knowledge of military routine. The Territorial army was mobilized with the Regular army on the outbreak of war, and these Territorial officers, belonging as they did to regiments and field ambulances, were at first to be found almost exclusively in the front line formations, but many of them now hold administrative positions and posts as divisional medical officers of hospitals. The Special Reserve officers are usually young men who before the war undertook to serve in the Royal Army Medical Corps if required, and meantime went through a course of three months' training, receiving a small retaining fee in respect of each year their names were kept on the roll.

The nursing staff is drawn from an equally large number of sources. Some belong to the Regular army, others to the hospitals which in peace nominally form part of the Territorial army, others are nurses who in peace work independently, and many come from the overseas commonwealths.

The great variety in the components of the R.A.M.C. is a source of strength, since it ensures the inclusion of men of varied talents and representative of special knowledge of all branches of medicine and surgery. The whole corps is administered in a spirit which secures unity of effort among men of different mental constitution and previous experience, yet without trammelling individuality by the imposition of other than necessary rules and regulations. It is to this that is mainly to be attributed the successful working of the Royal Army Medical Corps in France, but material assistance has also been derived from the sympathy extended towards all medical affairs for the benefit of the troops by the Commander-in-Chief.

SEA TRANSPORT.

The motor convoys at the front are army units, but the ambulance cars by which patients are taken from the base hospitals for shipment to England are maintained by the British Red Cross Society, and at some bases are driven by women. As not all the bases are at a port, a short journey in an ambulance train sometimes intervenes between a patient's departure from a base hospital and his embarkation.

The embarkation medical officer is informed day by day as to how many patients are waiting shipment, and the proportion of lying to walking cases, and as soon as a ship is ready notifies each hospital concerned how many patients of each kind he can accommodate. Arrived at the quayside, the ambulances are unloaded under the supervision of the embarkation medical officer, and as each case reaches the deck it is assigned a position on board according to its nature. Swing cots are used for the severer cases, since they can be approached from both sides, and to the less severe are assigned berths arranged in tiers. On long voyages walking cases are also given berths, but on short ones they are allowed to sit or stroll about as they please as soon as each man has been clad in a life-jacket. The next step generally is the serving of a meal and the distribution of cigarettes.

Meantime the lying-down cases are being treated as if they were still in a hospital on land, for every hospital ship has a staff of surgeons and nurses and all the equipment necessary for hospital work. All hospital ships have previously been passenger vessels, and the necessary room for wards is provided partly by re-equipping the dining and other saloons for their new use, partly by clearing the lower decks of cabins. Lifts are provided for moving patients, and the vessels are painted white, with a green band painted from stem to stern with a red cross painted in the middle. At night there is a long row of red and green lights along the taffrail on both sides.

HOME HOSPITALS.

Arrived at the port of destination the patients are received by a disembarkation medical officer and his staff, who have been warned by wireless telegraphy of the number of patients on board, and have caused to be brought up to the quay-side the requisite number of hospital trains; these trains are then loaded rapidly by stretcher-bearer parties and dispatched to different parts of Great Britain.

The more serious cases are usually sent to hospitals in the neighbourhood of London or the great provincial towns. Some of the larger institutions are military hospitals which existed before the war, but the great majority have been specially created. Some of these, however, previously had a nominal existence as Territorial hospitals, it being part of the system of the Territorial Force that at each local centre the larger civil hospitals should undertake to open if required a military hospital officered by medical men selected from their own staffs. The officers thus selected were given commissions *à la suite* in the medical department of the Territorial Force. Apart from large military hospitals of this and other kinds, including some maintained by the British and other Red Cross societies, a considerable proportion of all civil hospitals now have arrangements for the reception of military patients who are treated by the civilian staffs attached to these hospitals.

All the larger hospitals have special departments for patients whose successful treatment involves knowledge of one or other of the special branches of medicine and surgery. There are also very numerous convalescent homes, and the orthopaedic hospitals described by Dr. Colin Mackenzie (BRITISH MEDICAL JOURNAL, May 26th, 1917, p. 669 et seq.). Finally, there are numbers of camps to which are sent men who it is expected will recover their fitness for active service when they have undergone remedial exercises of various kinds and a general physical training.

The duty of seeing that an adequate number of hospitals for military patients are maintained in Great Britain, as also that of providing the reinforcements and stores required for the medical work of the armies in France, the Balkans, Mesopotamia, India, East Africa, and elsewhere, appertains to the Director-General of Army Medical Services in London, a post filled since November, 1914, by Surgeon-General Sir Alfred Keogh. He had held the same office some years previously, and returned to it in order to allow the actual occupant of the post, Surgeon-General Sir Arthur Sloggett, to take up work which it was realized would be of weekly increasing importance and for which his talents and experience seemed, and have abundantly since proved, specially to fit him—namely, the control of the medical affairs of the British armies in France. It is on the arrangements of these armies that this description of the work of the Royal Army Medical Corps is chiefly based.

So far as the British people is concerned the work of the Royal Army Medical Corps has given the greatest satisfaction, and it is believed that after the war, when details become known to those capable of assessing its more scientific aspects, it will be acknowledged that the corps has taken full advantage of opportunity offered for advancing precise knowledge of medicine and surgery as well as of means of handling vast numbers of sick and wounded men.

THE CANADIAN ARMY MEDICAL SERVICE.

BY

SURGEON-GENERAL J. T. FOTHERINGHAM, C.M.G.,

DIRECTOR OF MEDICAL SERVICES, INVALIDS, C.E.F.; LATE A.D.M.S. SECOND CANADIAN DIVISION.

THE adage, "Cast thy bread upon the waters, and thou shalt find it after many days," had never truer exemplification than in the relations found existing in this great war of all the ages between the R.A.M.C. and the Canadian A.M.C. The latter is the lusty progeny of the former, and well pleased that the physique and lineaments of the parent can be seen in the child. In all matters of present-day organization, equipment, and even uniform, the two services are closely homologated and interchangeable. But in spirit, and sympathy, and attainments, and just and generous emulation their relations are more fraternal than parental.

During the somewhat troubled years which followed in British North America after the rebellion of the American colonies the British troops who helped, as in the war of 1812–1815, to safeguard the feeble settlements of Nova Scotia, Lower Canada, and Upper Canada, had their medical officers—army doctors as they were known. Not a few of these well-trained men left the service to settle down to practice in Canada, and in most cases at once secured a commanding professional position in the new community. Their superior education and good social position gave to many of them great influence with the authorities, especially in Upper Canada—now Ontario—and this influence was always exerted in favour of sound legislation on all matters pertaining to education, both general and professional. The provinces were thus from the outset, to a very large extent, protected from the evils of free and unlicensed medical practice, from which the United States are only now with much effort and delay beginning to shake themselves free. British ideals in both teaching and practice have in the main prevailed everywhere in Canada, the precedent and example of the medical legislation in the older provinces being closely followed in the newer as they were organized, so that all the medical faculties in Canada have always drawn their inspiration, neither from American nor German sources, but from the great schools of London, Edinburgh, and Dublin.

With this heritage, nothing could be more natural and legitimate than that the Canadian Army Medical Service should both give and get, in this time of sore trial for all British hopes and ideals, absolute mutual co-operation and goodwill in its relations with the Royal Army Medical Corps and Service. The opportunity of comradeship and common service in the stricken field and in the cause of empire and civilization is keenly realized and most highly prized by all ranks.

The intimacy between the two services is evidenced by the circumstance that many scores of Canadian graduates hold temporary commissions in the R.A.M.C., and the value of their services is freely acknowledged by their fellow officers. Furthermore, the Canadian laboratory man has been given his chance and has made good in both British and Canadian laboratories in the field, and the friendly rivalry and hearty good comradeship of their work has gone far to make permanent for all time the good relations which are and can be based only upon mutual respect. One dreams of the day when the degree or licence of any reputable faculty in the empire may run and be recognized as valid in all the parts of the empire.

A summary of the activities of the C.A.M.C. may be made under the three topics:

1. Preventive medicine;
2. Clinical progress in medicine and surgery; and
3. Laboratory and research work.

PREVENTIVE MEDICINE.

With reference to preventive medicine the two outstanding features of the situation are:

(*a*) Preventive inoculation.
(*b*) Sanitary control in the field.

(*a*) *Preventive Inoculation.*

On the Western front, where most of the Canadian medical troops have been employed, this has been mainly against the typhoid group, small-pox, and tetanus.

The percentage of inoculated men as regards the first two runs very high, practically 100 per cent., as the conscientious objector is not recognized by the Canadian authorities and legitimate means have been found for overcoming the objections of the very few who were at first disinclined to submit.

Antitetanic serum has been administered in all main dressing stations to all wounded, and latterly to trench foot cases, at the time of their admission, the dose being entered on field medical card and in the admission and discharge book. The dose has been, as a rule, 1,500 units.

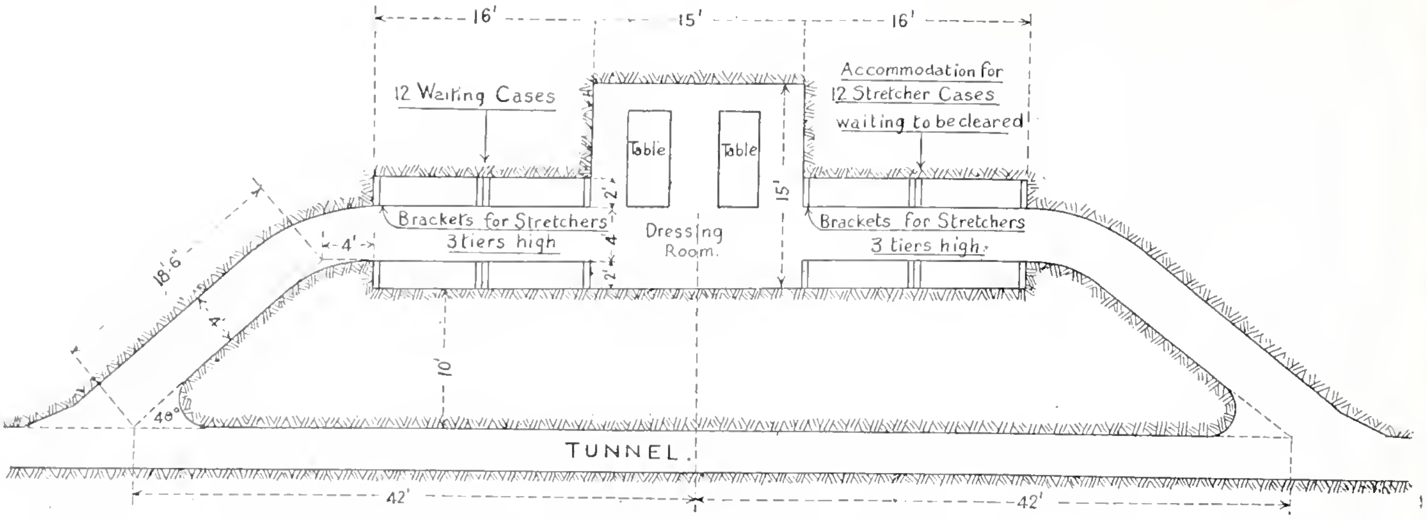
16'
15'
16'
12 Waiting Cases
Accommodation for 12 Stretcher Cases waiting to be cleared
Table
Table
15'
2'
4'
2'
Brackets for Stretchers 3 tiers high
Dressing Room.
Brackets for Stretchers 3 tiers high.
18'6"
4'
4'
10'
40°
TUNNEL.
42'
42'

FIG. 1.—Regimental Aid Posts in a Tunnel. Accommodation, 24 cases.

The serum has been to a large extent, but not exclusively, obtained from the Canadian Red Cross Society, and is that manufactured in the laboratories of the University of Toronto through the thoughtful provision of a wealthy benefactor there. The regular source of supply through the advanced dépôts of medical stores has also been drawn upon. Comparisons and results are not available as yet, but there is no doubt in the minds of all in a position to judge that, as a preventive measure, the procedure is proved to be indispensable.

The same remark holds true, if possible more positively, with regard to antityphoid inoculation. When regard is had to the practical absence of true typhoid and to the extraordinarily low incidence of the other diseases of the enteric group on the one hand, and to the universal contamination of the water supply by the colon group on the other, one may truly say that a new chapter may now be written in the history of military medicine, and that the world at large owes to Sir William Leishman and the R.A.M.C. a debt which it can never repay; and it should not be forgotten that the millions of men now in the war zone and far from their accustomed strains of enteric infection represent, without inoculation, virgin soil for the ravages of the disease.

Small-pox has been practically non-existent among the Canadian troops, as each man signs in his attestation papers an undertaking to undergo vaccination, which is universal.

Dysentery has occurred in a slight, sporadic form, but not as either epidemic or endemic. Such cases, even though only suspected, are sent to a special hospital in each army direct from the field ambulance, admitting by motor ambulance convoy car.

(*b*) *Sanitary Control in the Field.*

The two important parts of this many-sided problem are water control and disposal of waste. The organization necessary is briefly as follows:

1. Battalion and unit sanitary sections, specially detailed and trained by unit medical officers and employed under their direction. Responsibility rests with each O.C. for his own lines, the M.O. acting as adviser.

2. Divisional sanitary section under a specially qualified medical officer, who is also divisional sanitary officer, under command of A.D.M.S. of Division, reporting to him, and employing the other ranks of his unit as inspectors over the whole area occupied by the Division with reference to water supply, disposal of waste, and conservancy arrangements of every sort.

The opinion has been steadily growing that for the semi-siege type of warfare so far prevailing on the Western front, too frequent moves of these divisional sanitary sections detract seriously from their usefulness, and that they should, within limits, be made more permanently responsible for the areas with which they have become familiar, after the manner in which town majors and camp commandants are employed.

With respect to the protection of the water supply, in addition to the supervision maintained by the divisional sanitary sections, which is good, the Canadian corps has in action a water patrol. This patrol places a second check upon the chlorination of water.

Experience has shown that a water which gives a good reaction for the presence of free chlorine half an hour after the addition of chloride of lime can be considered a safe water. The requisite amount—1 gram (1 scoop), or more, to 110 gallons (the capacity of the water-cart)—is gauged by testing at frequent intervals during the day, the amount varying according to the organic content of the water. Small cases are supplied to the British Expeditionary Force, whereby sanitary or regimental medical officers may so test water and establish the amount of chloride of lime necessary to produce sterilization. Mobile laboratories are available to examine and give any information on request. Muddy water must first be filtered, otherwise sterilization will not be complete, the chloride of lime failing to penetrate to the centre of particles of mud.

Water patrols, covering a Canadian corps area, are in charge of an officer under the "Q" Branch. A survey is made, maps prepared, and information collected. The corps area is then subdivided into patrol sections, each section being patrolled by one N.C.O. and five men (permanent base). The duties of these patrols are as follows:

(*a*) To see that rivers, streams, ponds, wells, and springs are not polluted.

(*b*) To see that no washing and no watering of horses are done at any but authorized points.

(*c*) To see that no material connected with the corps water system is destroyed or removed without corps or divisional orders.

(*d*) To visit daily each of the water tanks, stand-pipes, etc., where water carts are filled, collecting the daily report from the "divisional control" in charge.

Divisions are responsible that all orders regarding chlorination and "water details" are carried out, and also all instructions, such as those mentioned in paragraph (*b*). Any unit not complying with instructions regarding water supply is reported by the water patrols to the water patrol officer, but this does not relieve divisions from their responsibility for seeing that all instructions are carried out. Where a unit is reported to the water patrol officer a report is forwarded to the division concerned. Should the same unit be reported a second time, a report is forwarded to corps head quarters. Men belonging to, or attached to, the divisional sanitary sections are detailed as "water controls" by the O.C. sanitary sections for all authorized supplies in the divisional area. These water controls keep a "daily tank report" in triplicate, which sets forth the condition of carts drawing water, condition of lime, etc. A copy of these reports is forwarded daily to the divisional sanitary officer, one copy to water patrol officer, and one copy is retained as record by the water control. The divisional sanitary officer is responsible that the necessary steps are taken to prevent a recurrence. The O.C. water patrols summarizes these daily tank reports once a week; a copy of this is sent to the D.D.M.S. A record is thus kept.

Other matters pertaining to the water supply are also reported to the D.D.M.S., and thus the medical services work in conjunction with the other branches to maintain as adequate and good a supply of drinking water as possible.

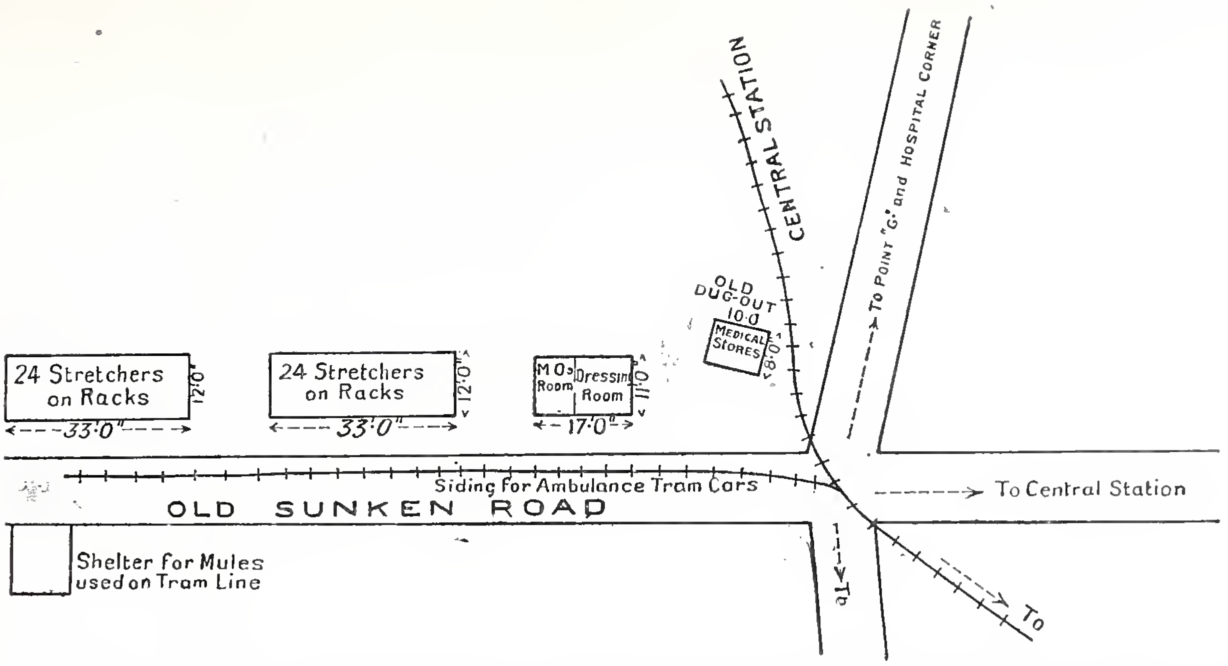

FIG. 2.—Advanced Dressing Station. Accommodation, 40 cases. This dressing station is situated in an old sunken road, and is fragment-proof. A siding has been placed in front of the station for hospital tram-cars, and a shelter has been built in the cut bank for the mules used in hauling tram-cars.

The incidence of water-borne diseases in the Canadian corps has been low, and it may be said has only occasioned anxiety when conditions were such as to interfere with, or prevent, the maintenance of those measures which have been indicated above.

Reference should be made to the very important topic of baths and laundries. In most British divisions it is understood that these establishments are under the control and administration of the A.D.M.S. for the "A and Q" branch of the staff. In the Canadian divisions the practice has been to relieve the medical service of this responsibility and to place in charge a capable business man who is an officer seconded from his unit to the staff of the division. This has given excellent results, and would seem to be less wasteful of the special training of the medical officers, though close co-operation always exists between the A.D.M.S. and the officer in charge of baths and laundries through the A.A. and Q.M.G. The Foden-Thresh lorry disinfector, for instance, which is on charge to the sanitary section and under the control of the A.D.M.S., is kept in operation at the divisional baths, where the men exchange their soiled clothing for fresh. Ordnance by arrangement makes issue of socks and underwear through the baths officer.

CLINICAL PROGRESS IN MEDICINE AND SURGERY.

The barest reference alone is possible to so wide a subject; a few topics of interest have been selected.

1. *Injuries and Diseases of the Lung.*

In a general way we have come to a set method of treating wounds of the lung, which usually reach the base hospital not earlier than the fifth day after infliction. Gunshot wounds rarely, shell wounds frequently, are complicated. Haemothorax is usually demonstrable, and the history of haemoptysis is generally present. The rapidity with which blood is spat up after wounding depends on whether the upper or lower part of the lung is wounded, the haemorrhage being most prompt in the case of the former. Fever is usually present in the earlier days, often disappearing by the sixth or seventh day. When the fever continues we draw off blood from the pleura for the purpose of culture; such cultures usually prove sterile. As a usual thing we draw off by aspiration the blood about the tenth day; sometimes the blood so drawn off is replaced in a few days by effusion, so that subsequent aspirations may need to be made. The blood so drawn off is sometimes replaced by oxygen, the outflow of blood and the inflow of oxygen being made through separate needles at the same time. Of late we have not felt so keenly the necessity for the use of oxygen; our idea was that the replacement allowed a less chance of disturbance of the bulk of the lung, with consequent haemorrhage. An uncomplicated case is fit to travel, we judge, about the thirteenth or fourteenth day. The possibility of seasickness and vomiting is the chief reason against allowing cases to travel at an earlier date, as the repair of the lung wound seems to be relatively slow.

With shell wounds of the lung, and in cases where the foreign body remains in the chest cavity, no set method of treatment is possible. The x rays and the fluoroscopic screen are used to the fullest extent in all these cases; a certain small percentage of patients with foreign body are found amenable to early operation with removal. The relative infrequency of infection of the pleural blood is remarkable. I have personally seen only two cases of gas infection of the pleural blood, both of which recovered. A number of other infections by large bacilli, which might have been gas bacilli, but were not certainly so, have been treated as empyema and drained, and, so far as we know, with recovery in all cases.

In a winter such as 1916–17, there was a great prevalence of infection of the respiratory tract, including pneumonia, but it is remarkable how little prevalent lobar pneumonia has been. Severe cases of bronchitis, tracheitis, and laryngitis are common, and loss of the speaking voice is very often seen. It is difficult to distinguish mild bronchopneumonia from severe cases of bronchitis, and the presence of pneumococcus is in no sense diagnostic, as most cases show it to be present. The diagnosis has to be made on clinical grounds, and most frequently a high degree of physical disturbance, continued high fever, and the presence of blood streaks, blood or rose colour in the sputum, is used to determine the diagnosis in favour of bronchopneumonia.

A tendency to extension of the disease from one part of the lung to another at different times in the course of the malady is remarkable, so that sometimes patients are ill for weeks, with apparent extensions of the disease: the final chart of such a patient looks like a typhoid fever chart; so true is this, that in many cases we have been compelled to make agglutination tests for typhoid and paratyphoid fever, with almost constantly negative results. The absence of sunny, clear weather in winter in the northern parts of France seems to be responsible for the slow convalescence of many patients suffering from disease of the respiratory tract.

2. *Continued Fevers (or "P.U.O." Cases).*

Considering the cases of continued fever (or "pyrexia of unknown origin") coming to the hospital, it becomes necessary to divide them into the constituent diseases—namely, typhoid and paratyphoid fevers, so-called trench fever, and other less specific infections. Since the whole army is inoculated, the clinician is no longer able to determine on clinical grounds whether a case of continued fever be typhoid, paratyphoid, or another. The classical signs of enlarged palpable spleen, rose spots, etc., are too often absent. A dirty tongue implies gastro-intestinal disturbances but is in no wise specific. The old-fashioned Widal test is useless because it is positive by reason of inoculation. It therefore becomes necessary to make a quantitative agglutination test, which is done in series; this is done at intervals of not less than four days, and the positive diagnosis of typhoid or paratyphoid "A" or "B" may be possible by observing that there is an agglutination curve and not a stable agglutination line. From this it will be inferred that a diagnosis is sometimes made by a quantitative fall in agglutination power as well as by a rise, the fall or rise depending upon the phase in agglutination power which the blood shows at the time it is taken. No longer is the typical typhoid temperature chart to be seen. Regular, more or less continued fever, or even an acutely relapsing fever is to be seen; patients belonging to this group show very frequently myalgic pains, pains in the neck, pains in the thighs, pains in the shin bones, so that a diagnosis of the so-called trench fever upon clinical grounds becomes as difficult as a diagnosis of typhoid and paratyphoid fever. All the cases admitted into one base hospital during a certain period last winter with the provisional diagnosis of pyrexia of unknown origin—that is to say, cases which were clinically transient pyrexias with no symptoms beyond the elevation of temperature and malaise—were examined bacteriologically, and it was demonstrated that 68 per cent. were typhoid or paratyphoid. Blood cultures and examinations of the stools for typhoid and paratyphoid fever were singularly useless. During the winter 150 cases suspected of typhoid or paratyphoid, whose stools were examined three times in succession, gave no positive result on any occasion.

3. *Methods of Localizing Foreign Bodies.*

A large percentage of the work done in an operating room of a base hospital in war time consists in the removal of foreign bodies. It is essential that this should be done with the least possible amount of traumatism, and this means that the position of the foreign body should be definitely known before the operator begins to work. The localization of these foreign bodies becomes therefore almost an art in itself, and the development of that art—if one may so call it—in the course of this war would be perfectly amazing to a civil surgeon. It is proposed, therefore, to give as briefly as possible an account of the different methods used to locate accurately any foreign body.

For foreign bodies of known dimensions—for example, rifle bullets and shrapnel balls—a Canadian radiographer, Captain A. Howard Pirie, has devised a very ingenious scale, based upon the fact that the shadow of the foreign body increases in size as the plate is removed farther from the body. Suppose, then, the plate to be in contact with the skin, all that one has to do is to measure the size of the skiagram of the foreign body, and compare it with the scale, which will at once indicate the depth from the skin surface of the foreign body. A reference to the cross section atlas will then at once give one the position of the foreign body.

The Mackenzie Davidson method, by triangulation, of localizing the depth of a foreign body from a mark, placed previously upon the skin, is in constant use for all foreign bodies, such as pieces of shell, which are of unknown size.

If there is reason to believe, after measuring the depth of the foreign body and comparing it with the atlas, that the foreign body is in the thorax or the abdomen, a stereoscopic view is then taken and the location of the body is easily determined by looking into the adjustable stereoscopic apparatus.

As aids in the operating-room, we place first the large electro-magnet bearing the name of Bergonié of Paris. By its use can be determined the exact position of all electromagnetic substances, and, fortunately, German bullets are electro-magnetic, whilst the English and French bullets are not. Even when these bodies are deeply situated, and their vibration cannot readily be made out by the hand, it can easily be heard by the stethoscope, placed on the skin opposite the electro-magnet. A sound, very like a steamboat whistle, indicates the nearest point to the foreign body, and the skin is marked at that point. In the case of non-magnetic foreign bodies, such as lead, brass, and nickel, or in the case where a magnetic foreign body is embedded in bone, and therefore cannot vibrate, we have recourse to the use of the telephone probe or, rather, forceps. This is of great assistance in locating the foreign body, either in the soft tissues or in the bone, and enables us to extract it with a minimum of damage to the tissues. In other cases, again, when the foreign body will not vibrate, or has possibly changed its position in the soft parts since the *x*-ray picture was taken (and this is notably so with foreign bodies in joints), we operate under the fluoroscopic screen.

It should be borne in mind that practically all the stationary and general hospitals sent by Canada have come from the medical faculties of the universities. A list of these it would not at the present juncture be wise perhaps to publish, but the fact that each one includes in its personnel the selected specialists and teachers in all branches of medicine and surgery from every medical faculty in the country, ensured from the outset a very high standard of professional efficiency. In addition, effective military administration has in most cases been secured, as in most of the universities there were medical men of military experience, both in the militia and in the South African war, and in the Canadian permanent service.

It is no improper divulging of official secrets to say that, both in the Mediterranean area and in France, the highest army medical authorities state that they have found these Canadian units second to none in the whole service. Their facilities for good service, too, are enhanced by the possession in several instances of large funds subscribed by the friends of their universities at home for additions to their equipment and supplies.

LABORATORY AND RESEARCH WORK.

The third main topic suggested at the outset of this article was laboratory and research work. Again, figures and statistics may not be given; and in any case could be as yet only partial. But valuable work has been done by Canadian workers, both in Canadian mobile laboratories and in collaboration in British units, in Britain, in France, and in the Mediterranean.

An enormous volume of work has been done also as part of the daily routine of the general and stationary hospitals, which requires time for the making of generalizations. Special researches of which one has heard have been made upon continued fevers, pyrexias of unknown origin, nephritis, trench fever, stomatitis, meningitis, and epidemic jaundice.

DENTAL SERVICES.

No account of the work of the C.A.M.C. would be adequate which failed to recognize the good work of the dental officers.

The dental profession in Canada is entirely distinct from the medical in respect of both training and control. There are separate Acts of Parliament for each of the professions in all the provinces. It may be that these circumstances underlay the decision of the late Minister of Militia to establish a separate Canadian Army Dental Corps. Members of the dental corps are posted one to each field ambulance in the field, and to each casualty clearing station and stationary and general hospital. In addition, there is a corps dental laboratory, where artificial dentures are made and repaired with very little loss of time or delay, such as was the case when there was no laboratory nearer than the base in France. The loss of military time from dental causes has been reduced to a minimum.

Apart from the value of their professional services to the troops at the front, which cannot be overstated, the dental officers with field ambulances take their full share of military duty in their units, on the same footing as the medical officers, and have thus still further proved their indispensability.

In France the dental service has been placed completely under the medical service, as it was realized that only one channel would be permitted for which a man might, for reasons connected with health, be allowed to escape duty. The arrangement has been completely effective and satisfactory to both dental and medical officers.

The thanks of the writer are due for their collaboration in the production of this article to various officers, and among them: Lieut.-Colonel A. P. Bazin, O.C. — Canadian Field Ambulance. Lieut.-Colonel F. S. L. Ford, C.M.G., A.D.M.S., — Canadian Division. Lieut.-Colonel John McCrae, Lieut.-Colonel J. M. Elder, — Canadian General Hospital. Major A. C. Rankin, D.D.M.S. Staff, Canadian Corps. Major J. S. Jenkins, D.A.D.M.S., — Canadian Division.

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9

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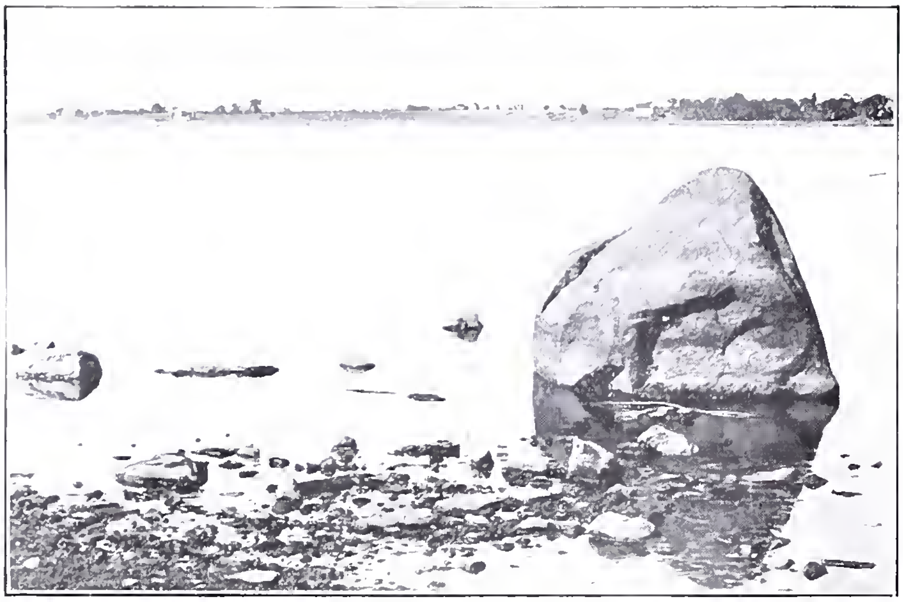
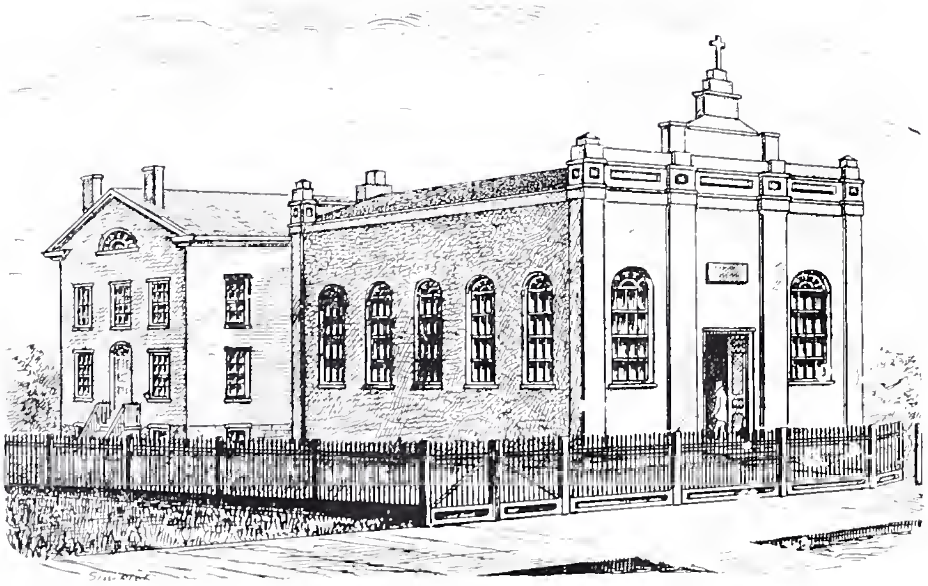


MECHANIC'S ROCK, ON THE MISSISSIPPI



FIRST CATHOLIC CHURCH IN DUBUQUE

Johnson Brigham

Major-General Grenville M. Dodge,
GRAND MARSHAL
GRANT MONUMENT MUNICIPAL INAUGURAL PARADE

[illegible] completion [illegible] the Grant Monument [illegible]
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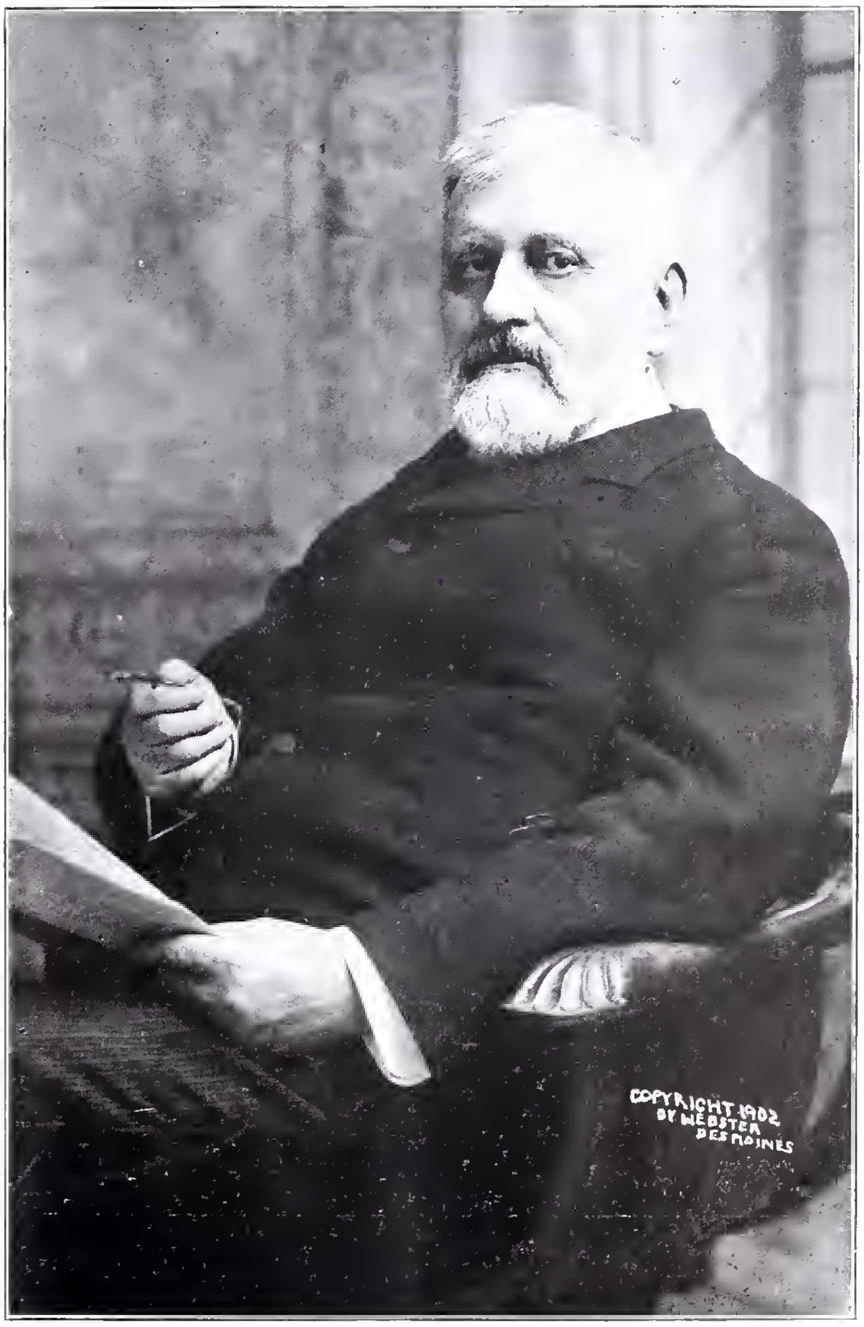
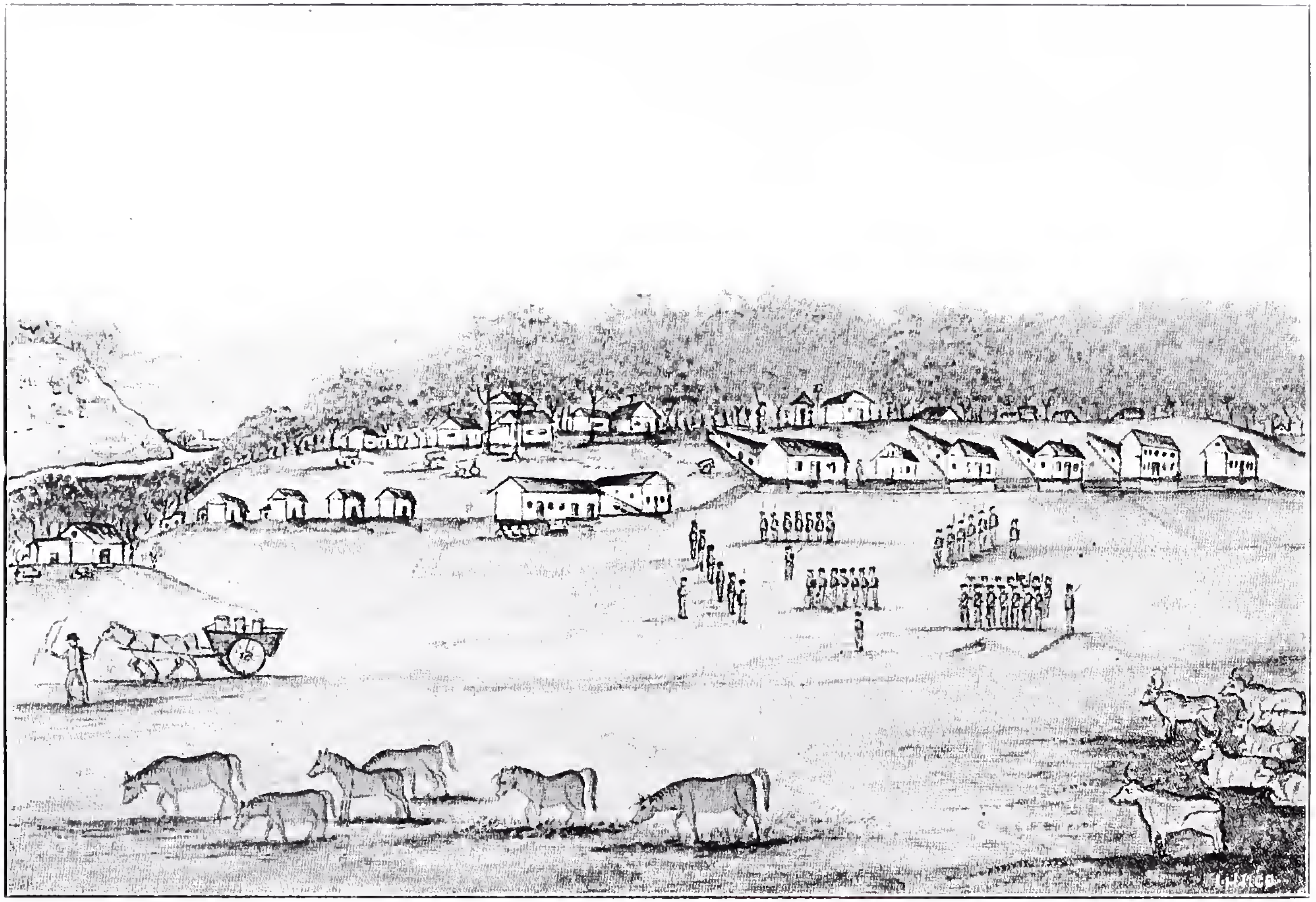


WILLIAM B. ALLISON

SAMUEL J. KIRKWOOD



From a pencil sketch by the late Mayor William Williams

FORT DODGE IN 1850

JAMES W. GRIMES

JAMES HARLAN

PIONEER EDITORS AND AUTHORS

Iowa: Its History and Its Foremost Citizens

AUTHOR'S INTRODUCTION

A PURPOSE long under consideration has at last taken form in a history of Iowa written from the viewpoint of personality,—a history the aim of which is to show the extent to which great minds—minds possessed of vision, ambition, initiative—have developed a sparsely inhabited wilderness with undreamt of resources and possibilities, into a great commonwealth set apart on the map as "Iowa."

Here is an area of fifty-six thousand square miles, lying between the upper Mississippi and the Missouri, over which for centuries there roamed the savage descendants, or conquerors, of an ancient civilization,—mere nomads with only a traditional past and without thought of the future beyond provision for their immediate necessities and the treasuring of tribal hatred and revenges.

The Indian pre-emptors of this region hunted and fished and fought and died and left behind them a scarcely more authentic memorial of their existence than we have of their contemporaries, the elk and the buffalo.

But for the oncoming of the white man, our Iowa would today be little if any further advanced toward the ideals of a world-civilization than it was in that far-off summer of 1673, when the pioneer priest, Marquette, and the intrepid explorer, La Salle, floating down the Wisconsin and out into the Mississippi, feasted their vision on "the beautiful land."

The superficial Chesterfield saw in history "only a confused heap of facts"; but the thoughtful student of history cannot fail to find that the social and political movements of his own time have sprung from roots deeply buried in the past.

The greatest fact in history is the Great Man—the man in whom are happily combined broad vision, well-directed purpose, forceful yet tactful initiative, and unabating industry.

Regarded from this viewpoint, Iowa has been fortunate in her history.

The first white man known to have set foot upon her soil was a missionary imbued with a great purpose; and piloting him was a voyageur with an absorbing passion for discovery.

Adventurers floated past her eastern boundary but saw no promise in mere land, however fertile it might prove to be. Fur-traders penetrated her inland streams but remained no longer than was necessary to possess the treasures of the chase.

Then came the soldier-explorers, investigators and defenders of savage weakness against savage strength—Kearny, Albert Lea, Fremont, Street and Allen, who separately invaded the interior, not to destroy and lay waste, but to conserve, to build up.

In due time our isolated farmers and small communities, along our borders and interior rivers, united in a formidable demand for admission to the Union, and after repeated summons the door was thrown open, and the region—once part of the vast empire known as the Louisiana Territory, and later, respectively, a part of Michigan, Wisconsin and Iowa Territory—was accorded a place among the sisterhood of commonwealths and was named the State of Iowa.

From the first, large men, men who saw their opportunities, comprehended their duties and dared to maintain their rights, were accorded seats in the councils of the State, and there saw to it that "the State's collected will," was embodied in statutes and crystallized into a code, contributing to the working out of their dream. Emerson, in a strangely pessimistic mood, once wrote—

"*Things* are in the saddle
And ride mankind."

The history of Iowa tells a different story. Long before the birth of the commonwealth, and ever since that event, *men* have been in the saddle directing the movement of mere things. In this respect, the Kipling of our day is wiser than was the Sage of Concord, when he wrote the familiar lines:

"Things never yet created things—
Once on a time there was a *man*."

Iowa: Its History and Its Foremost Citizens

At all times in Iowa history there have been *men*,—creative souls that rose to emergencies and mastered material things,—men divinely commissioned for leadership who, nevertheless, humbly recognized the collective wisdom of "the plain people."

The development of the history of Iowa from the earliest period down to and including its second Heroic Period, Iowa's patriotic part in the great World War, and the presentation of Historical Biographies of Iowans who are conspicuously a part of that history, is the present purpose of

THE AUTHOR.

THE HISTORY OF IOWA WILL INCLUDE:

Part I.

A Wilderness Discovered and Occupied.
The Indians.
The Discoverers.
The Pioneers.

Part II.

From an Unidentified Region to a Great Commonwealth.
The Louisiana Purchase.
The Territory of Michigan.
The Territory of Wisconsin.
The Territory of Iowa.

Part III.

Iowa's Development as a State.
The Formative Period.
The Heroic Period.
The Period of Reorganization.
The First Decade of the New Century.
The Second Decade well Begun.

Part IV.

Iowa's Heroic Part in the World War.

———WITH———

Biographical Sketches Illustrative of the Several Eras of Iowa's Progress.

Iowa: Its History and Its Foremost Citizens

Among the Historical Biographies in this great work are the following:

Julien Dubuque—First Settler on Iowa Soil.

General Joseph M. Street—Pioneer Indian Agent and Reformer.

Captain James Allen—Founder of Fort Des Moines and of Iowa's State Capital.

General Augustus C. Dodge and General George W. Jones—Pioneer Senators.

Dr. William Salter—Pioneer Preacher and Historian.

James W. Grimes and James Harlan—Pioneer Anti-Slavery Champions and Iowa's First Republican Senators.

Samuel Freeman Miller—Associate Justice of the Supreme Court of the United States.

George G. Wright and Chester C. Cole—Pioneer Jurists and Educators.

Theodore S. Parvin—Territorial Librarian, Educator and Publicist.

Samuel J. Kirkwood—Iowa's War Governor.

Benjamin F. Gue—Founder of Iowa's Agricultural College.

Grenville M. Dodge and Marcellus M. Crocker—Leaders of Iowans in the War for the Union.

Samuel Calvin—Iowa's Great Geologist.

William B. Allison—Iowa's Pre-eminent Post-bellum Statesman, and James F. Wilson, prominent in War and Reconstruction Legislature.

Colonel David B. Henderson—Farm Laborer, Lawyer, Congressman, Speaker of the National House of Representatives.

William Larrabee—Iowa's Pre-eminent Reform Governor.

General Francis M. Drake—Soldier-Governor and Philanthropist.

John F. Duncombe—Defender of the Frontier Against the Indians.

Judge L. G. Kinne—District Judge, Journalist and Supreme Court Justice.

Jonathan P. Dolliver—Iowa's Famous Orator and Statesman.

George D. Perkins—Pioneer Journalist and Representative in Congress.

Henry Wallace—Iowa's Pre-eminent Agricultural Editor.

Horace E. Deemer—One of Iowa's Pre-eminent Jurists.

PUBLISHERS' NOTE.

In 1915, under the general title of "Iowa: Its History and Its Foremost Citizens," appeared a work that met with remarkable favor from both press and people. It was written, as the author states, from the viewpoint of Personality; and well has he carried out his aim, as its many readers testify. The work is not a mass of dry statistics compiled from public records; but, going back to the landing of Marquette and Joliet on Iowa soil, it shows, step by step, how great men with great minds, clear vision and patriotic purpose, toiled on and on until what was once a vast wilderness has been converted into one of the greatest and most prosperous states of the Union. The work as originally published was too large for general use in the home and school, and the author has been importuned by educators in all parts of the state, and by many others of Iowa's most appreciative people, to bring out an edition that may find its way into every school and home in the state.

This work was first made possible by the public spirit of many prominent citizens of the state who had confidence in the ability of Mr. Brigham to give to Iowa what it had long needed—a complete, comprehensive, accurate and readable history—one that would visualize for the reader, and particularly for the young reader, the succession of leading events in the development of the commonwealth, and, too, the men who have contributed most to that development.

The success of the work was so complete, both from a literary and an educational viewpoint, that men who believed that nothing could be of higher educational value to the youth of Iowa, or a greater inspiration to Patriotism, than a widespread knowledge of the glorious record of their State, united in urging the author and the publishers that an edition be prepared which might go into every patriotic, enlightened Iowa home, thus widely presenting the high ideals and the great deeds of Iowa citizenry.

It was urged, first, that this Home and School Edition be placed financially within the reach of all; further, that it be durably bound and in convenient form for young and old.

These conditions have been met in the present moderate-priced edition, in Two Volumes, bound in the stoutest, most durable and yet most attractive Library Buckram.

It was further urged that all of historic value in the first edition be preserved in the second, together with such revision and additions as the stirring events of the past few years might suggest.

In compliance with this demand, the original chapters have been thoroughly revised, all the historic biographies included and several biographies and chapters added, bringing the work down to, and including, Iowa's glorious part in the Great War. Not only this, but the accuracy of every statement has been verified by an expert historian connected with the State Historical Society; so that it is today a generally accepted standard Iowa History.

Again, it was suggested that to the history be added an account of the patriotic zeal with which Iowa, both in the field of agriculture and the economic arts and in the field of arms, responded to the call of President Wilson to make both America and "the World Safe for Democracy." It is a wonderful story, that of the manner in which Iowa has sent forth her best and bravest men of every racial descent, vying with one another in loyal sacrifice. It is a wonderful story, also, in that the very soil seemed to respond to the call of patriotism, making Iowa's products the hope of a warring and suffering world. All this is told for the first time, in comprehensive and permanent form, in the portions added by Mr. Brigham to his great History.

The last suggestion acted upon was that, in order to hold the interest of all, and particularly the young, the History be profusely illustrated. This has been done by the retention of the historic illustrations in the first edition and by the addition of many others; presenting for the first time in book form, authentic illustrations of the army camps and Camp Dodge, together with portraits of the leaders under whom Iowans are preparing for their contemplated march to Victory.

A unique feature of this history of Iowa is the large number of graphic and authentic biographies of the men who have helped to make Iowa great. Through these pen-pictures the names connected with Iowa history cease to be names only—they become vivid, living personalities. The reader learns of their struggles and disappointments as well as their great achievements, and on closing the volume he feels

WHEN IOWANS COME TO CAMP

IOWA RECRUITS ARRIVING AT CAMP DODGE

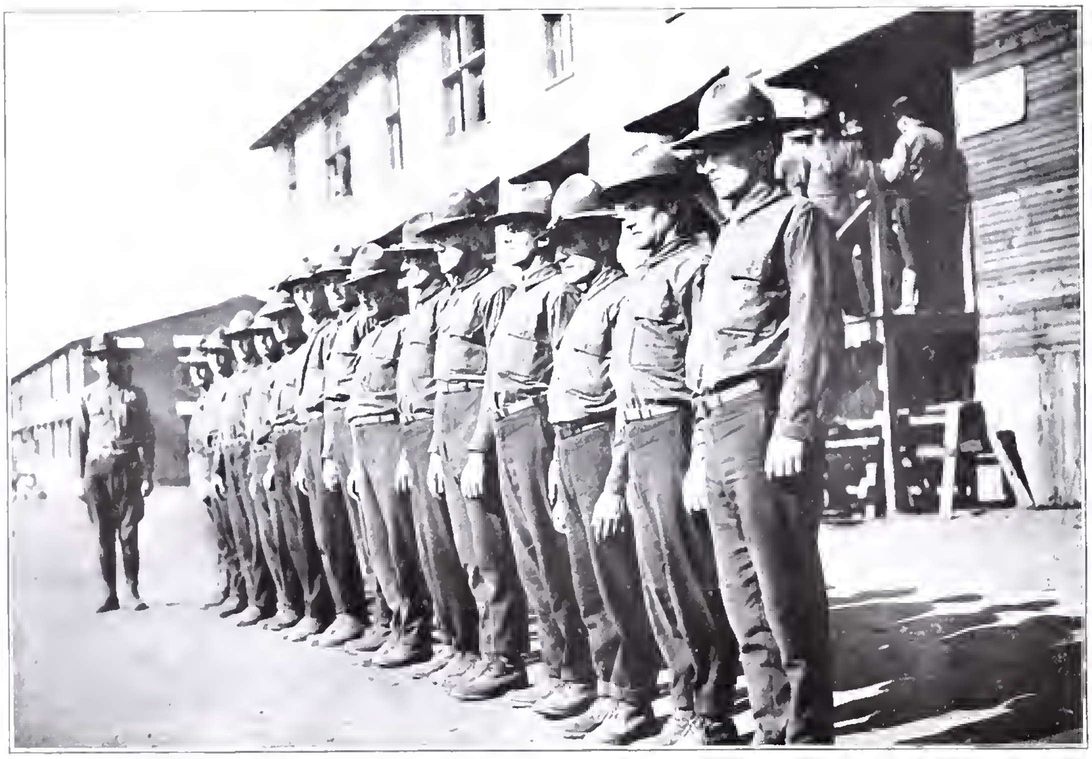
VIEWS OF CA

(Photos by Waterloo Ph

GE, DES MOINES

Company, Waterloo, Iowa)

RIFLE PRACTICE AT CAMP DODGE



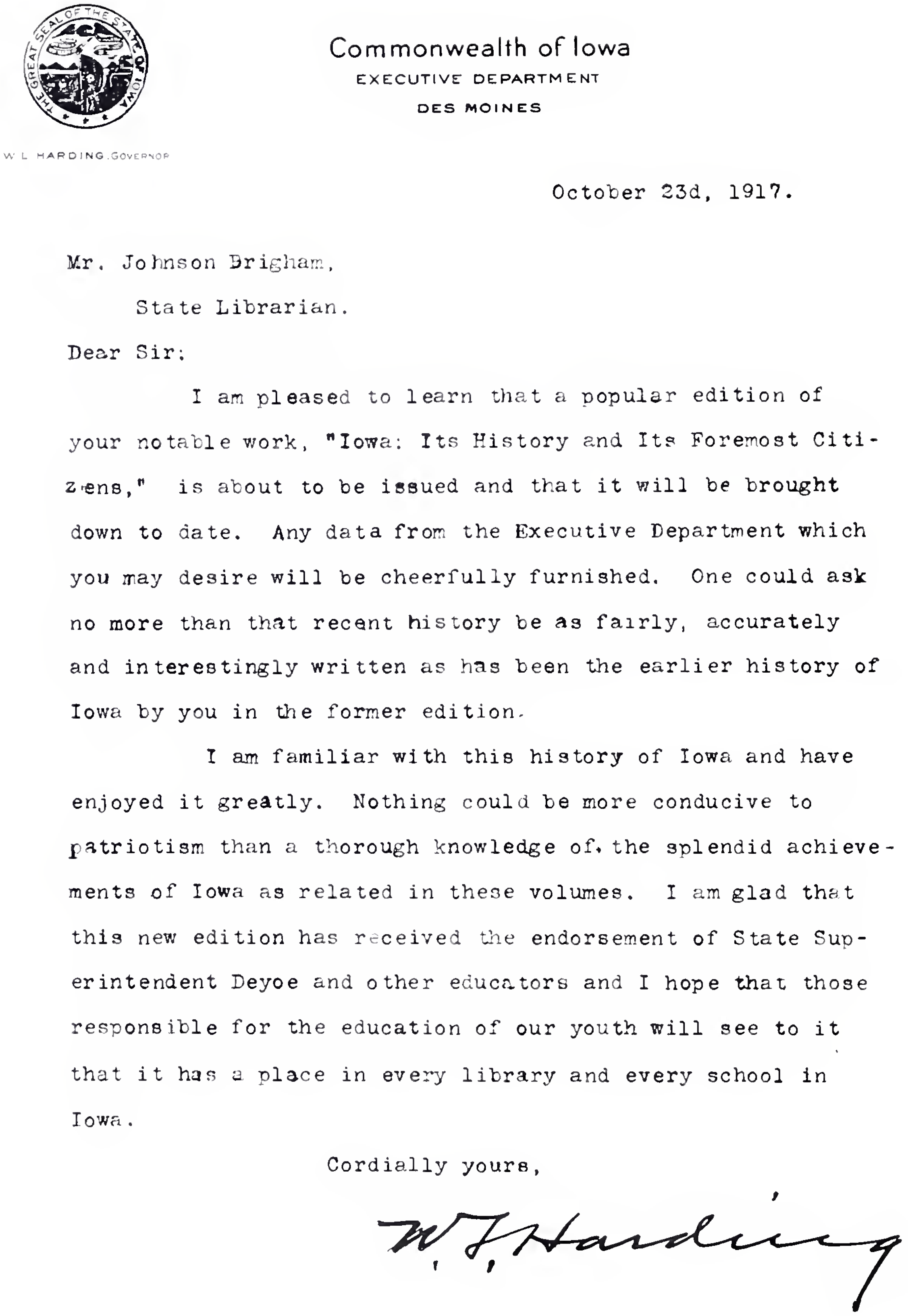
SIOUX CITY MEN IN COMPANY A

that he has established a friendly, intimate acquaintance with real, flesh-and-blood people. This feature is an inspiration to youth and, to their elders as well. To adult readers it opens up the flood-gates of memory, vividly recalling the master-minds of other years.

To summarize: the Home and School Edition of "Iowa: Its History and Its Foremost Citizens," now offered, has been thoroughly and critically revised and re-edited. It is replete with hundreds of illustrations. It has been brought down-to-date, including the leading events of Governor Harding's administration, the mustering in and departure of Iowa's troops, and the assembling, at Camp Dodge, of thousands of citizen-soldiers from Iowa and neighboring states. The work is bound in two handsome and substantial volumes and printed on superfine, durable paper. Its value as an authentic and readable history is attested by such a competent judge as the Iowa Superintendent of Public Instruction, who unqualifiedly recommends it to the school libraries of this great commonwealth. It is not only the best and most comprehensive history of Iowa, but it is the peer of any state history in the United States.

It is, therefore, with great confidence that this revised and perfected Home and School Edition of "Iowa: Its History and Its Foremost Citizens" is presented, strictly on its merits as a work of great interest and educational value. The emergency of War has centered the attention of educators upon the necessity of arousing patriotic sentiment and they are unitedly of the opinion that one of the best methods for attaining this desirable end is by bringing to every youth and to every citizen a complete history of his own state. This is the high mission of the new Home and School Edition of Mr. Brigham's History of Iowa, a mission which it admirably fulfills.

THE S. J. CLARKE PUBLISHING COMPANY.



Commonwealth of Iowa
EXECUTIVE DEPARTMENT
DES MOINES

W. L. HARDING, GOVERNOR

October 23d, 1917.

Mr. Johnson Brigham,
State Librarian.

Dear Sir:

I am pleased to learn that a popular edition of your notable work, "Iowa: Its History and Its Foremost Citizens," is about to be issued and that it will be brought down to date. Any data from the Executive Department which you may desire will be cheerfully furnished. One could ask no more than that recent history be as fairly, accurately and interestingly written as has been the earlier history of Iowa by you in the former edition.

I am familiar with this history of Iowa and have enjoyed it greatly. Nothing could be more conducive to patriotism than a thorough knowledge of the splendid achievements of Iowa as related in these volumes. I am glad that this new edition has received the endorsement of State Superintendent Deyoe and other educators and I hope that those responsible for the education of our youth will see to it that it has a place in every library and every school in Iowa.

Cordially yours,

W. L. Harding

Normal Training in High Schools
A. C. FULLER, JR., INSPECTOR

Rural and Consolidated Schools
JAMES A. WOODRUFF, INSPECTOR

Graded and High Schools
M. R. FAYRAM
JOHN L. CHERNY } INSPECTORS

State of Iowa
Department of Public Instruction
ALBERT M. DEYOE, SUPERINTENDENT
FRANK D. JOSEPH, DEPUTY
B. W. HOADLEY, CHIEF CLERK
Des Moines

October 13, 1917.

TO WHOM IT MAY CONCERN:

Considerable emphasis is being placed in different states on the teaching of local history. We are in sympathy with the idea and believe that more attention should be given to the teaching of our state's history in the public schools.

The history of our own state would be interesting reading for the boys and girls in their homes. Honorable Johnson Brigham, State Librarian, has prepared a two volume History of Iowa worthy of a place in every home library and in every school library.

Yours truly,
A M Deyoe
Superintendent of Public Instruction

Normal Training in High Schools
A. C. FULLER, JR., INSPECTOR

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State of Iowa
Department of Public Instruction.
ALBERT M. DEYOE, SUPERINTENDENT
FRANK D. JOSEPH, DEPUTY
B. W. HOADLEY, CHIEF CLERK
Des Moines

August 7, 1917.

Hon. Johnson Brigham,
Historical Building,
Des Moines, Iowa.

Dear Mr. Brigham:

Every school in Iowa should possess a copy of your book "Iowa: Its History and Its Foremost Citizens". It is filled with good things and would be an inspiration to all of our young people. It is gratifying to know that you have put out a school edition that may be sold within reach of every school corporation.

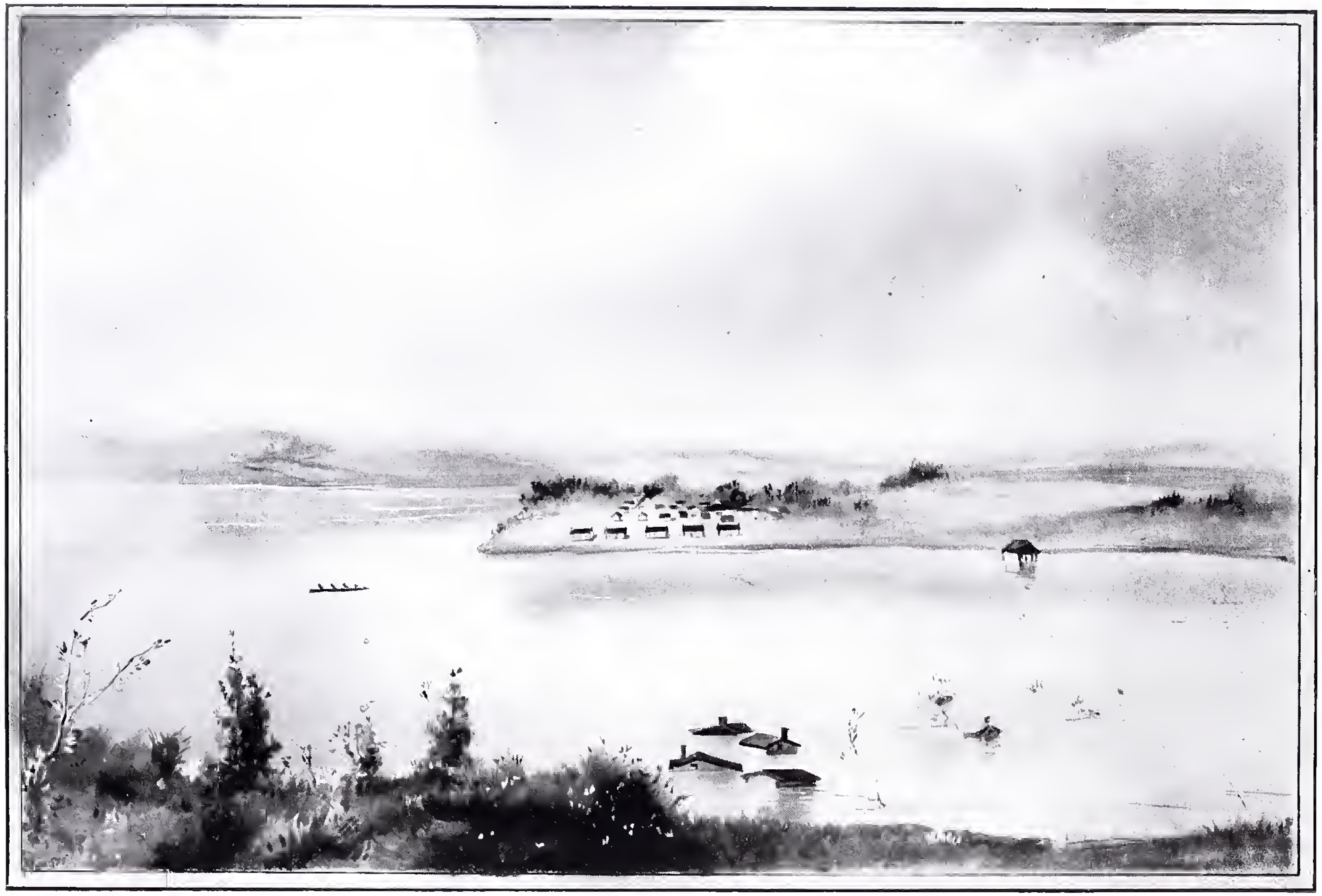
After carefully reading your book, I am frank to say that you have taken many dry historical statements and made them into real live language that challenges the attention of every reader. I predict for this book a substantial sale.

Iowa has long needed a history of the state penned by one with keen imagination yet one who keeps "actual facts" within the bounds of truth. This you have done in a marked degree. I believe it is one of the very best state histories now upon the market.

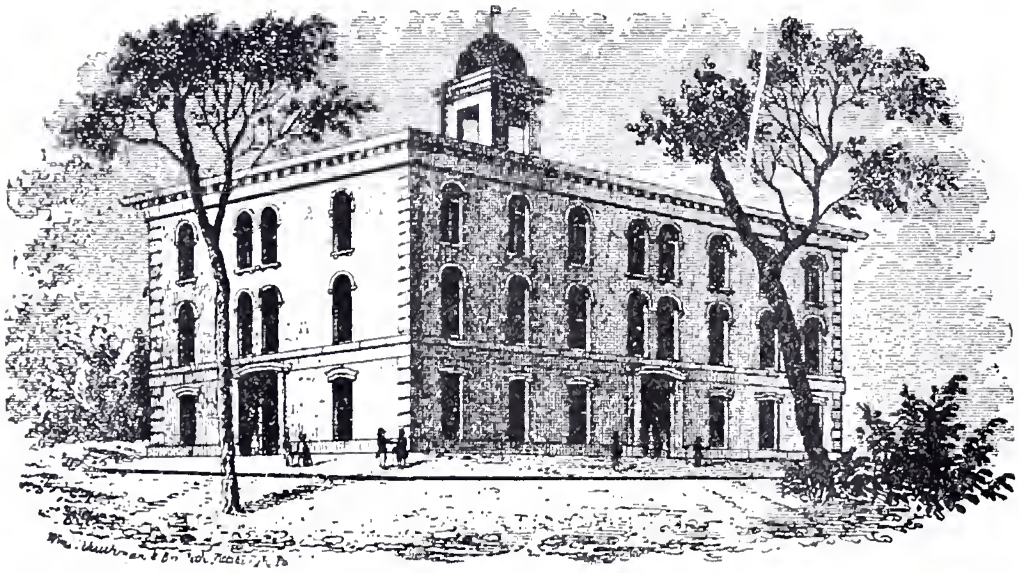
Respectfully yours,

Frank D. Joseph

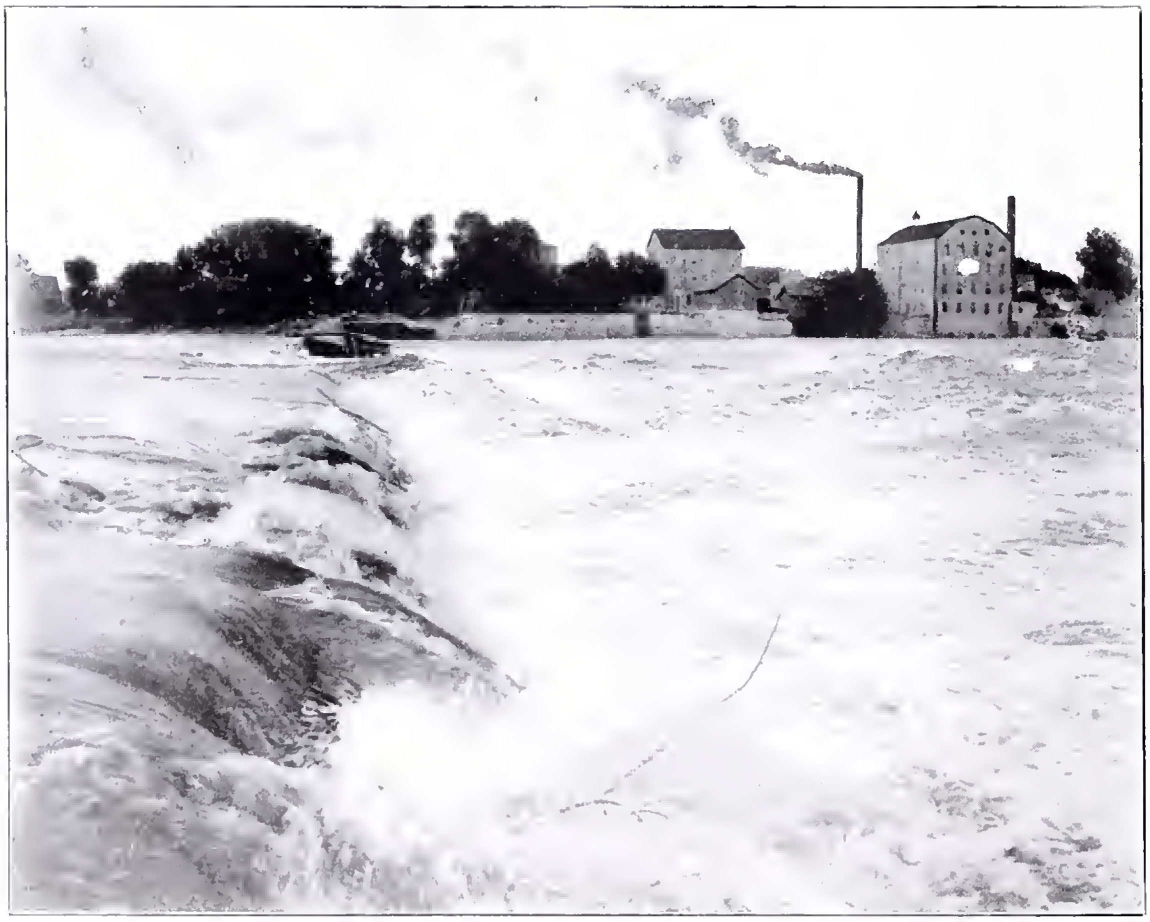
Deputy State Superintendent.



FORT DES MOINES IN 1851, SHOWING THE UNPRECEDENTED FLOOD OF THAT YEAR



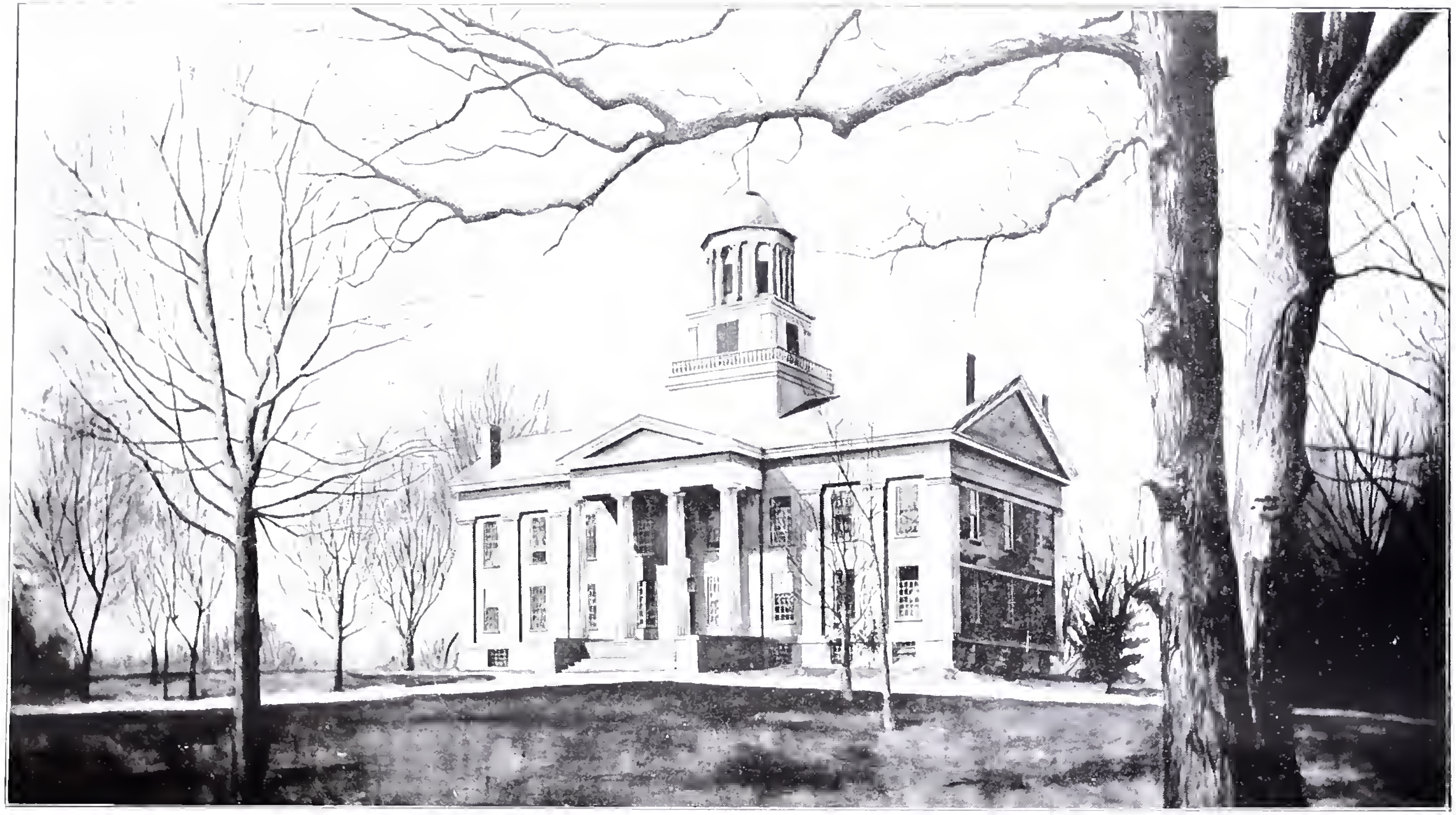
OLD CAPITOL AT DES MOINES. ERECTED IN 1857, OCCUPIED UNTIL 1886



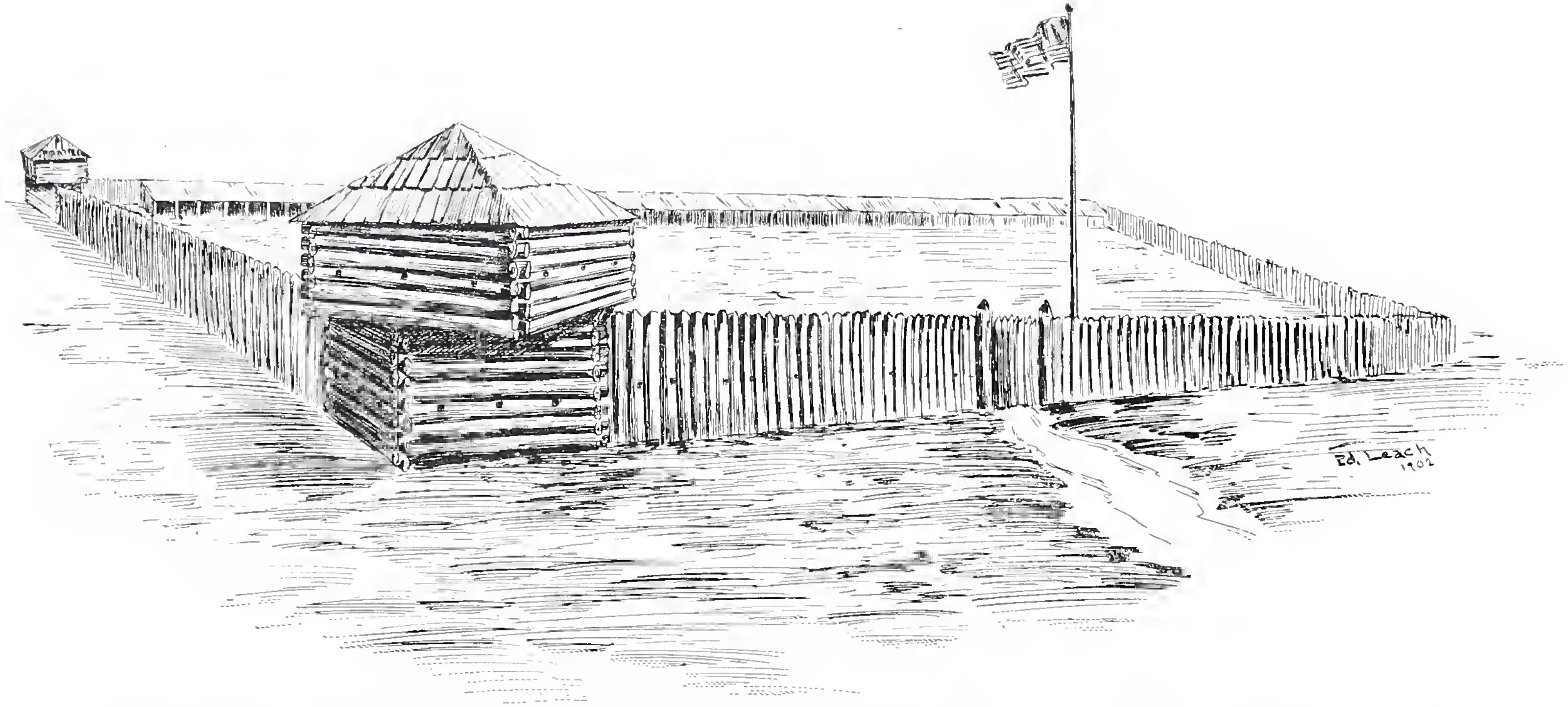
BONAPARTE MILL ON THE DES MOINES RIVER

LOG SCHOOL HOUSE IN JACKSON COUNTY

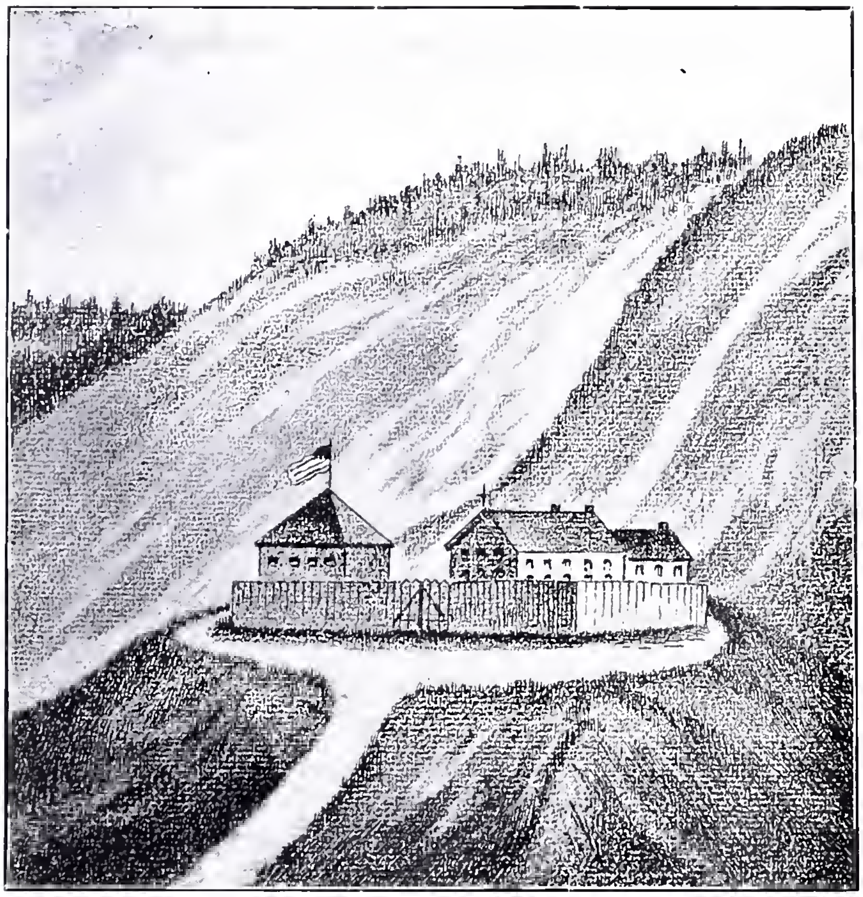
THE MAXSON HOUSE, NEAR SPRINGDALE, WHERE JOHN BROWN DRILLED HIS MEN FOR THE HARPER'S FERRY RAID IN 1858-9



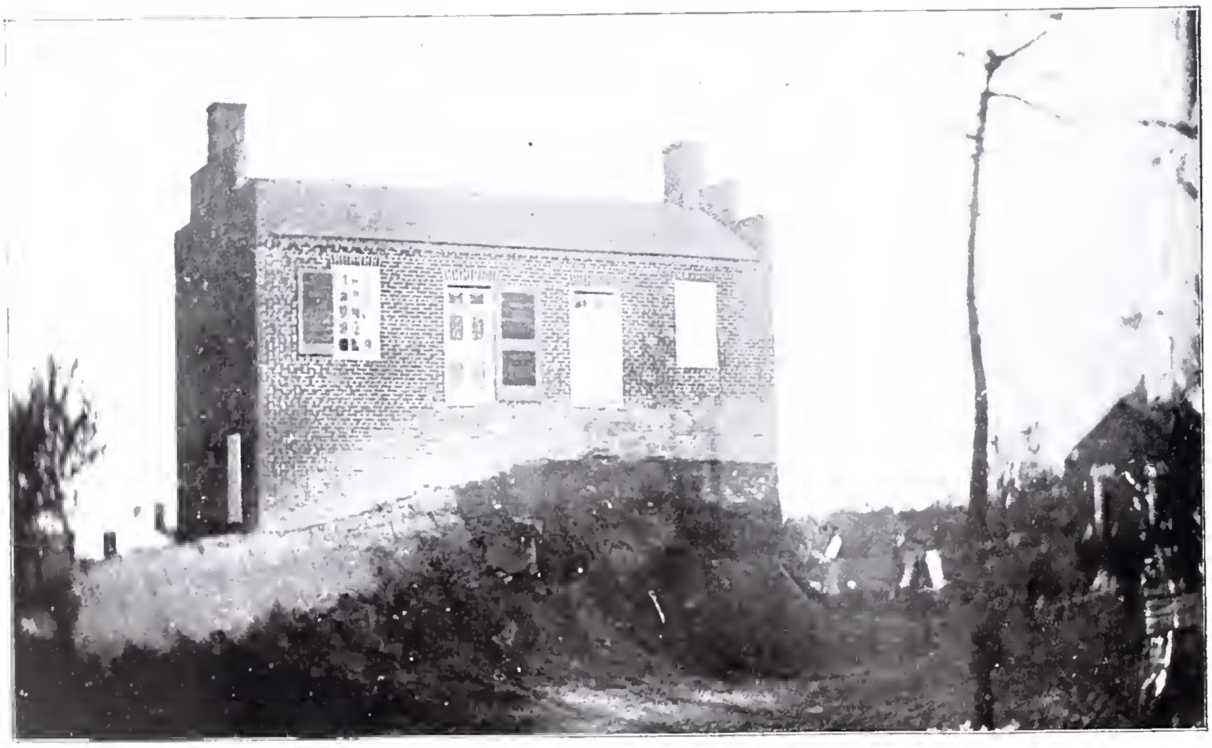
OLD STONE CAPITOL AT IOWA CITY, SINCE USED BY THE STATE UNIVERSITY



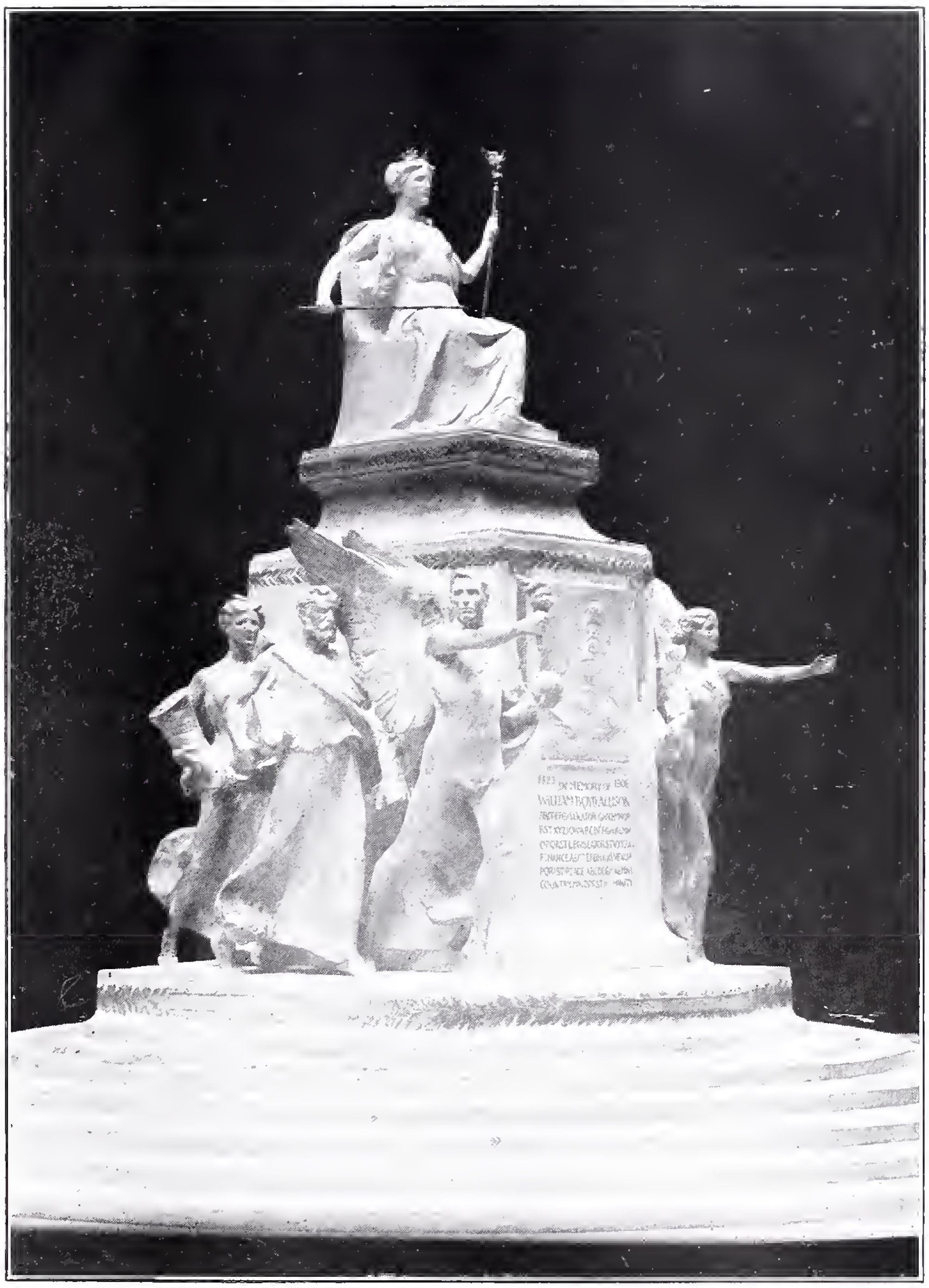
STOCKADE AT CORRECTIONVILLE, ERECTED IN 1862 AS A DEFENSE AGAINST HOSTILE INDIANS



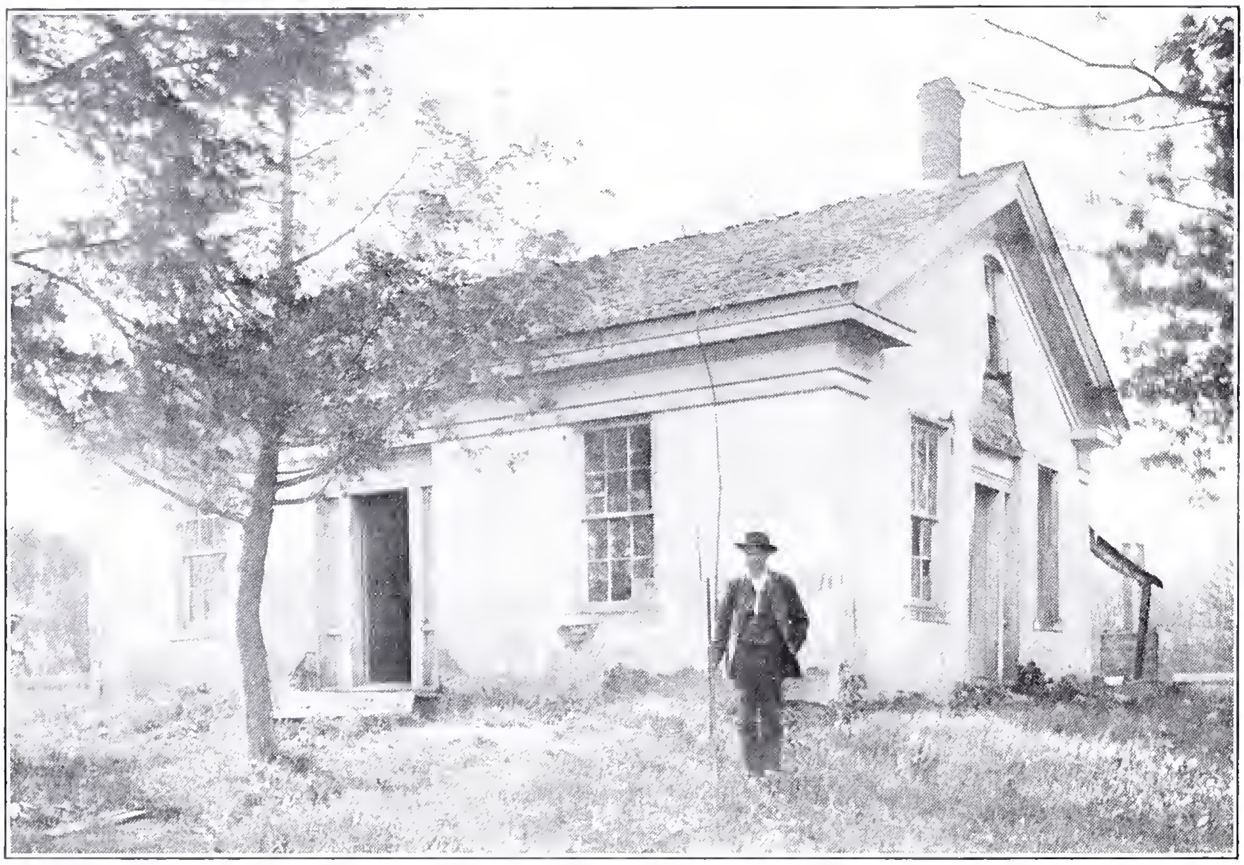
OLD BLOCKHOUSE, ERECTED IN 1838, WHERE COUNCIL BLUFFS STANDS



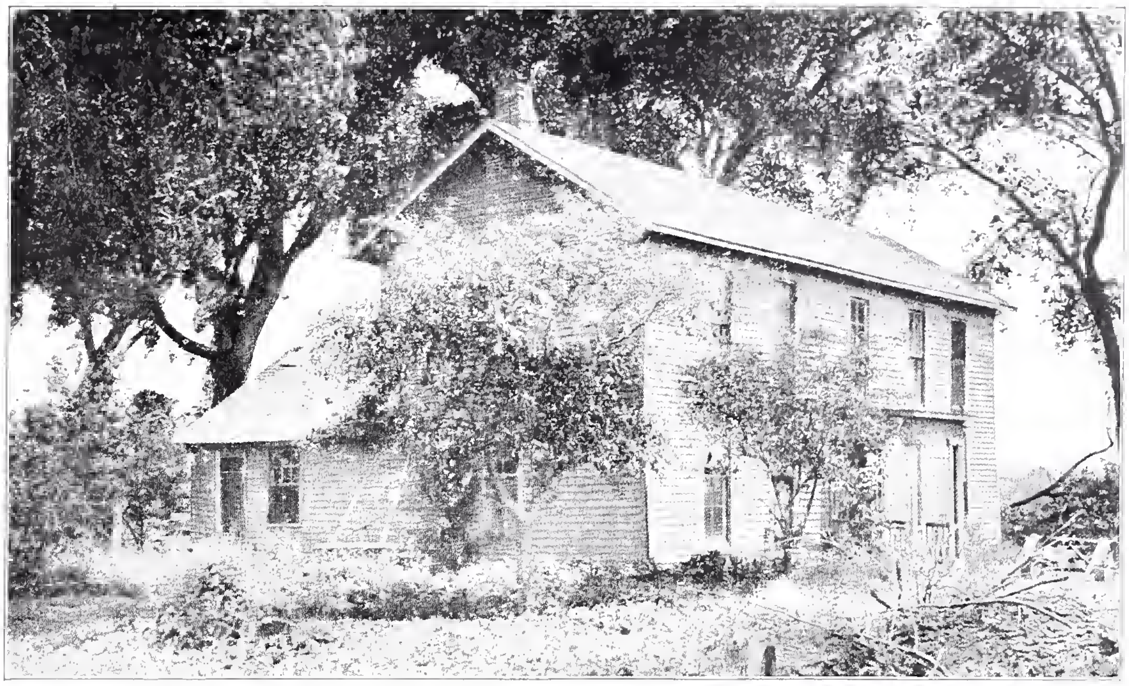
IOWA'S FIRST BRICK HOUSE, BURLINGTON



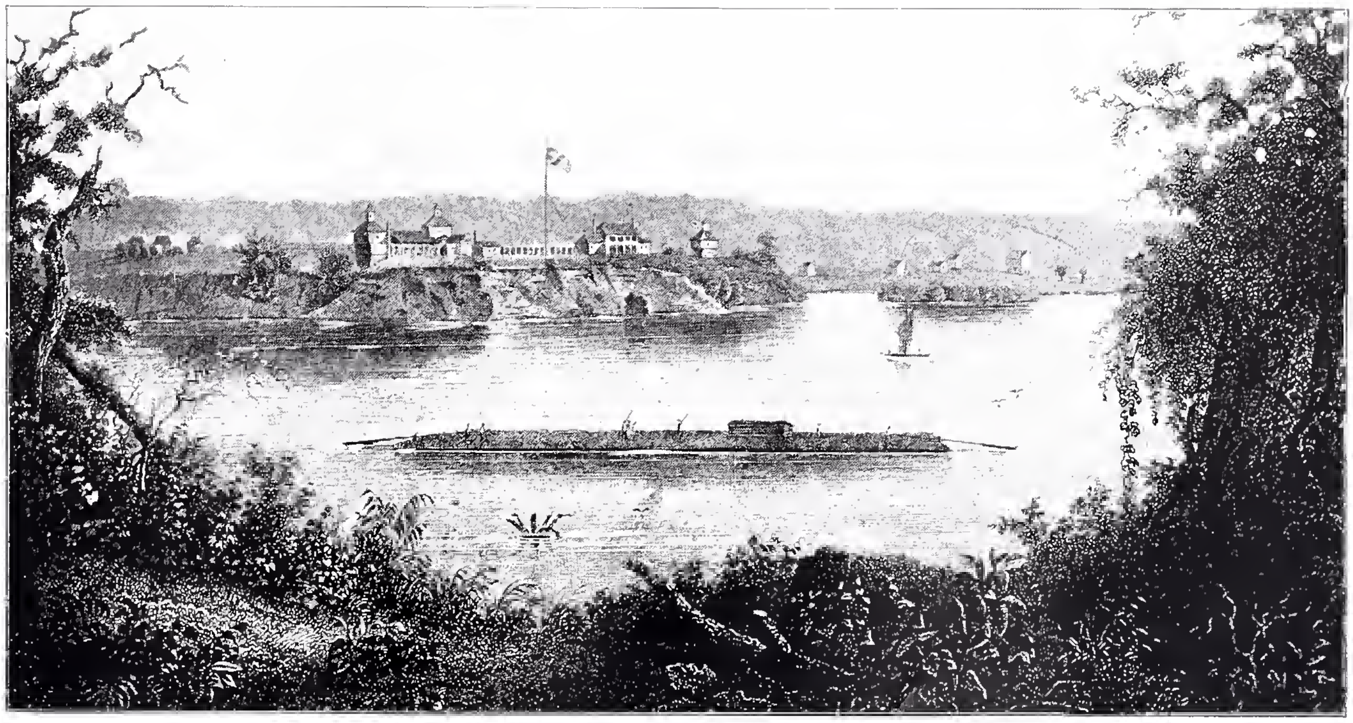
IN MEMORY OF WILLIAM BOYD ALLISON



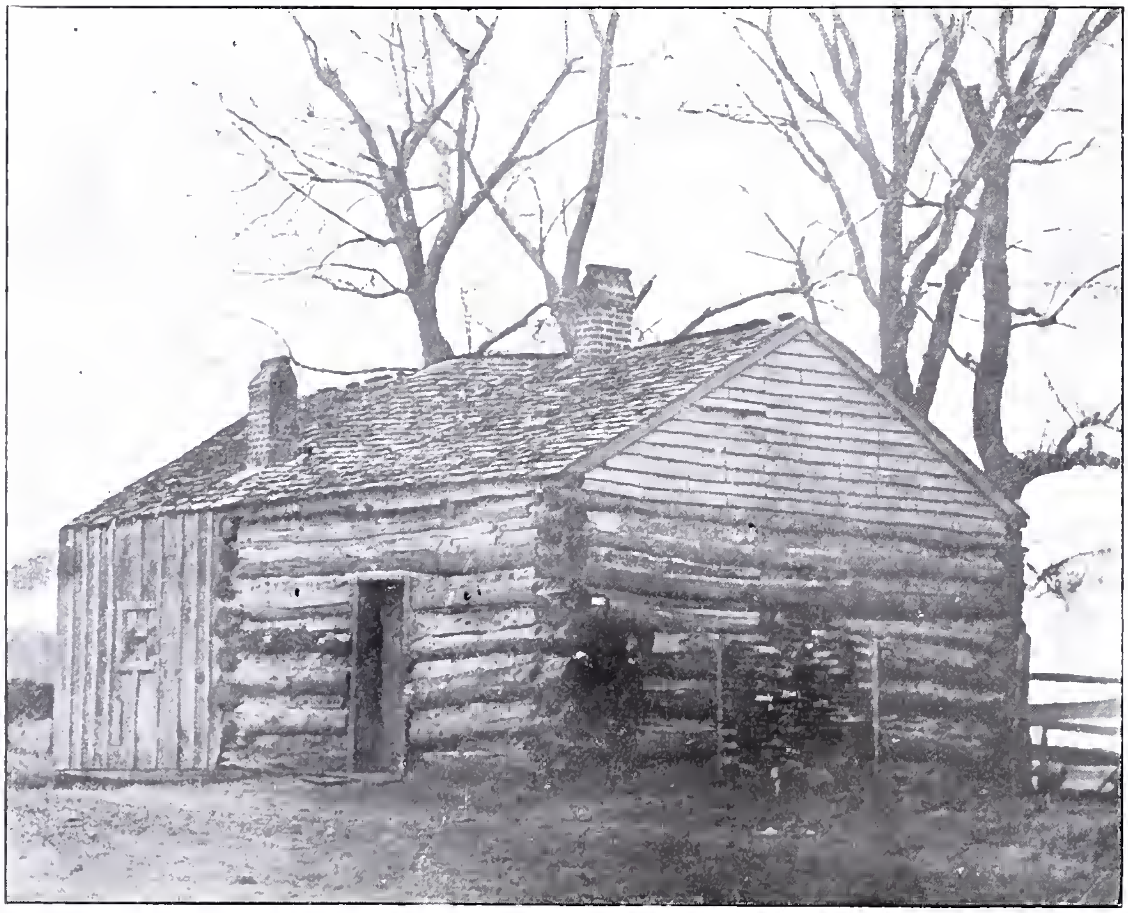
JOHN BROWN'S TEMPORARY RESIDENCE IN SPRINGDALE, IOWA



THE OLD INDIAN AGENCY AT AGENCY CITY, WAPELLO COUNTY, THE OFFICIAL RESIDENCE OF GENERAL STREET



FORT ARMSTRONG, ON ROCK ISLAND



FIRST LOG CABIN IN FORT DES MOINES

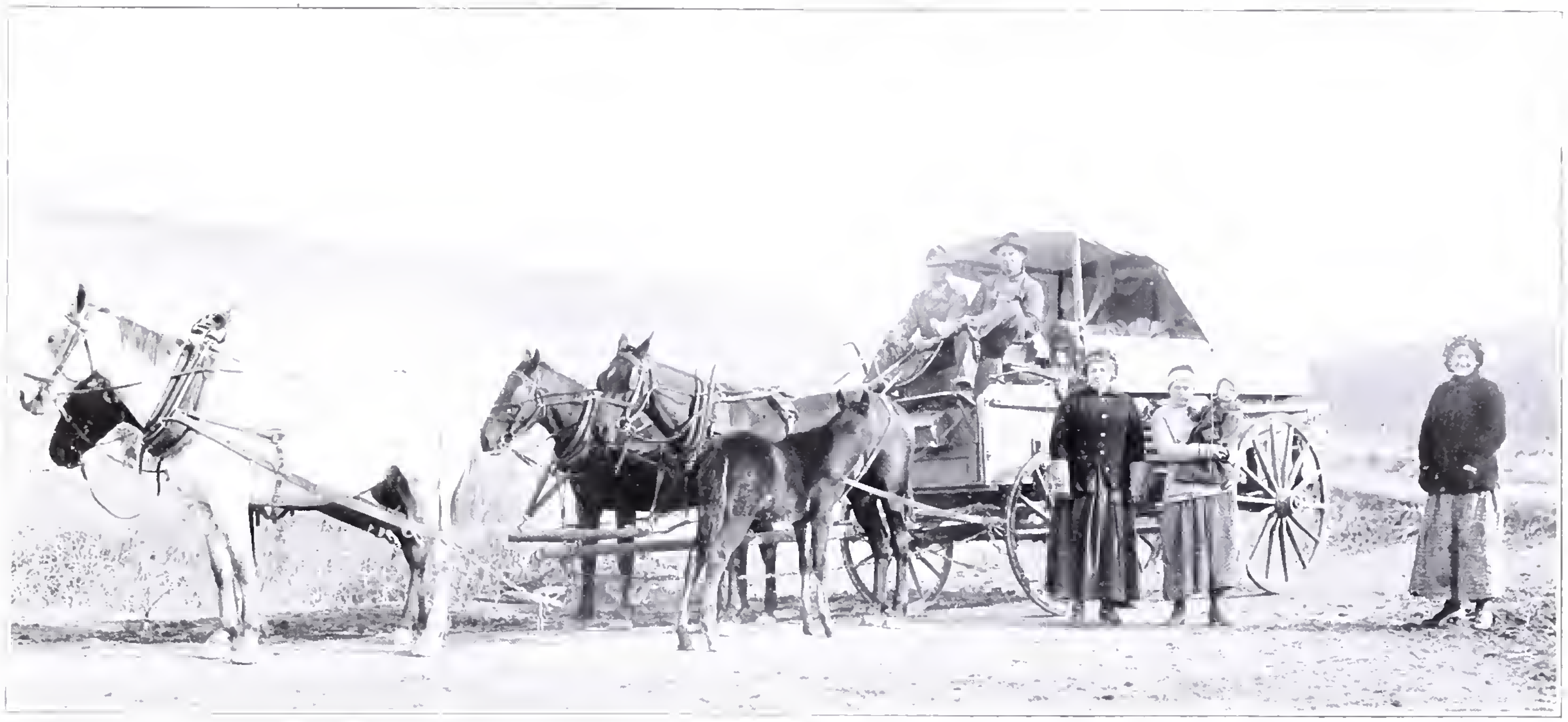
J. P. DOLLIVER

COL. D. B. HENDERSON

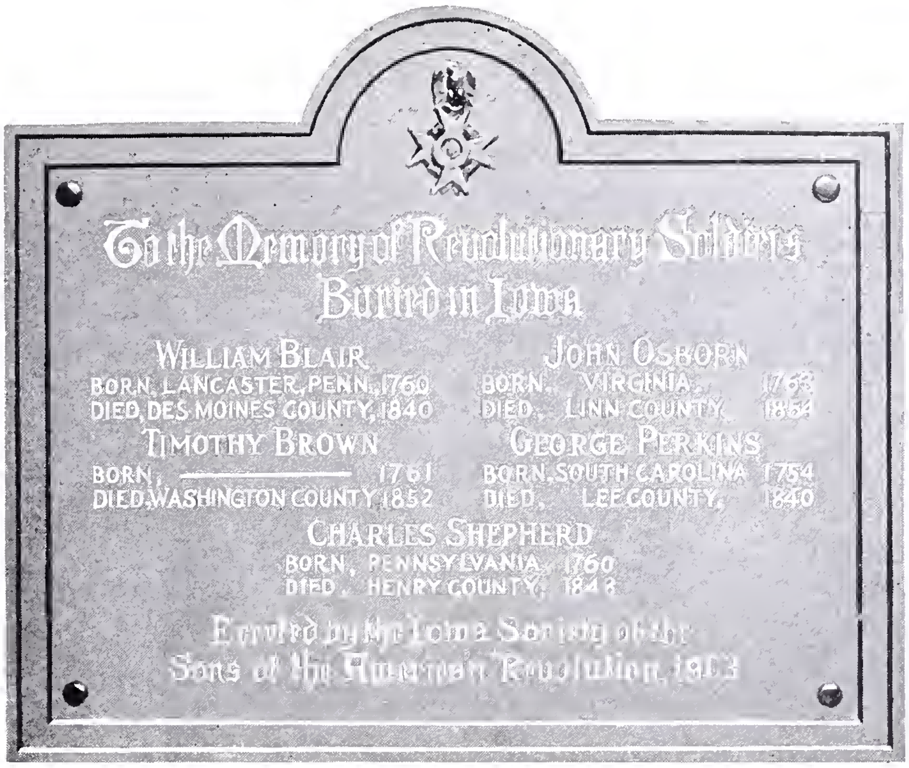
JUDGE L. G. KINNE

GEN. N. B. BAKER

WM. LARRABEE



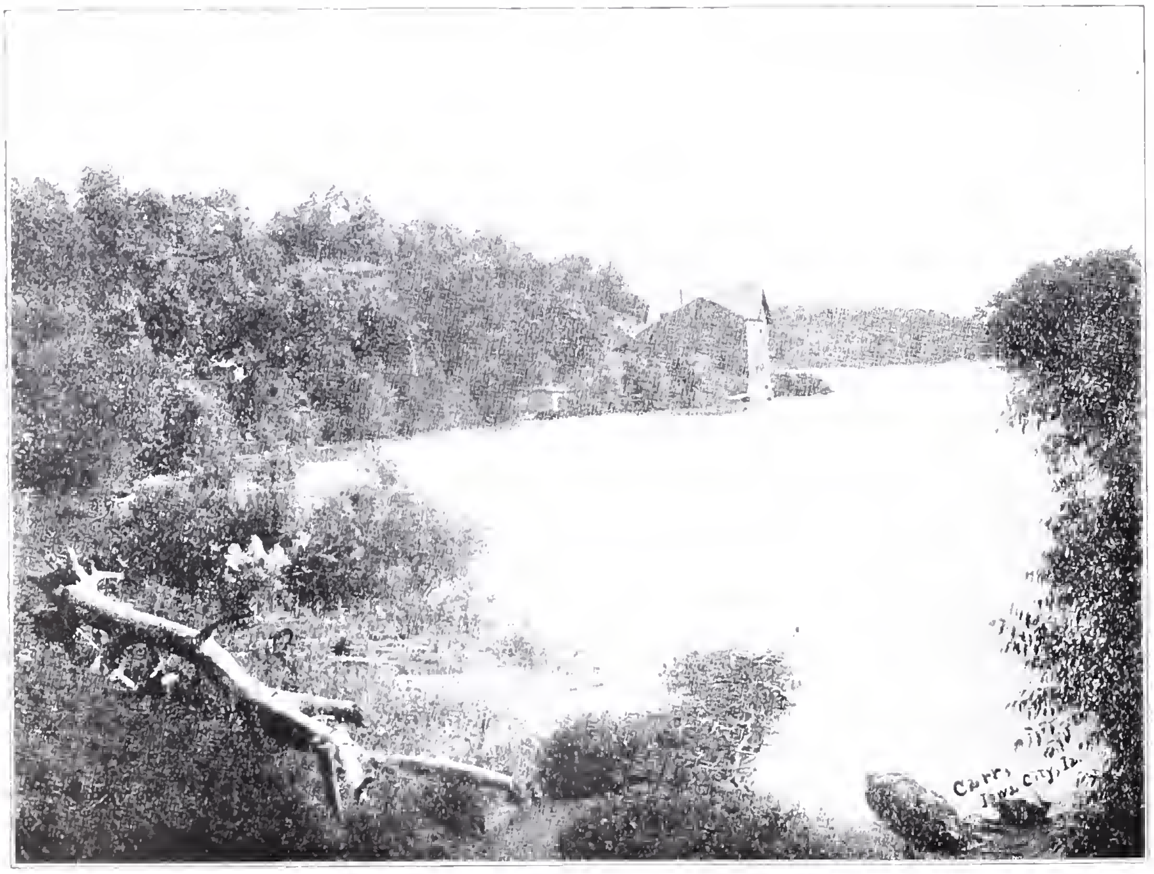
PRAIRIE SCHOONER


To the Memory of Revolutionary Soldiers
Buried in Iowa
WILLIAM BLAIR
BORN, LANCASTER, PENN., 1760
DIED, DES MOINES COUNTY, 1840
JOHN OSBORN
BORN, VIRGINIA, 1763
DIED, LINN COUNTY, 1854
TIMOTHY BROWN
BORN, 1761
DIED, WASHINGTON COUNTY 1852
GEORGE PERKINS
BORN, SOUTH CAROLINA 1754
DIED, LEE COUNTY, 1840
CHARLES SHEPHERD
BORN, PENNSYLVANIA, 1760
DIED, HENRY COUNTY, 1843
Erected by the Iowa Society of the
Sons of the American Revolution, 1903

TABLET IN MEMORY OF IOWA'S REVOLUTIONARY SOLDIERS, IN THE HISTORICAL BUILDING, DES MOINES

GEORGE D. PERKINS

MOUTH OF THE WISCONSIN RIVER WHERE MARQUETTE DISCOVERED IOWA. IOWA SHORE IN THE DISTANCE BEYOND THE MISSISSIPPI RIVER



MILL ON THE IOWA RIVER FROM WHICH KIRKWOOD WAS CALLED TO BE GOVERNOR

Let Music Swell the breeze
And ring from all the trees
Sweet Freedom's Song.

Freedom's Song

A NEW CARDINAL PATRIOTIC SONG, TO BE SUNG AND LIVED BY ALL AMERICA—IN THE HOME, IN THE CHURCH IN THE SCHOOL—EVERYWHERE.

THE SPIRIT OF 1918

"The destruction of every arbitrary power anywhere that can separately, secretly and of its single choice disturb the peace of the world."—From President Wilson's speech at Mount Vernon, July 4, 1918.

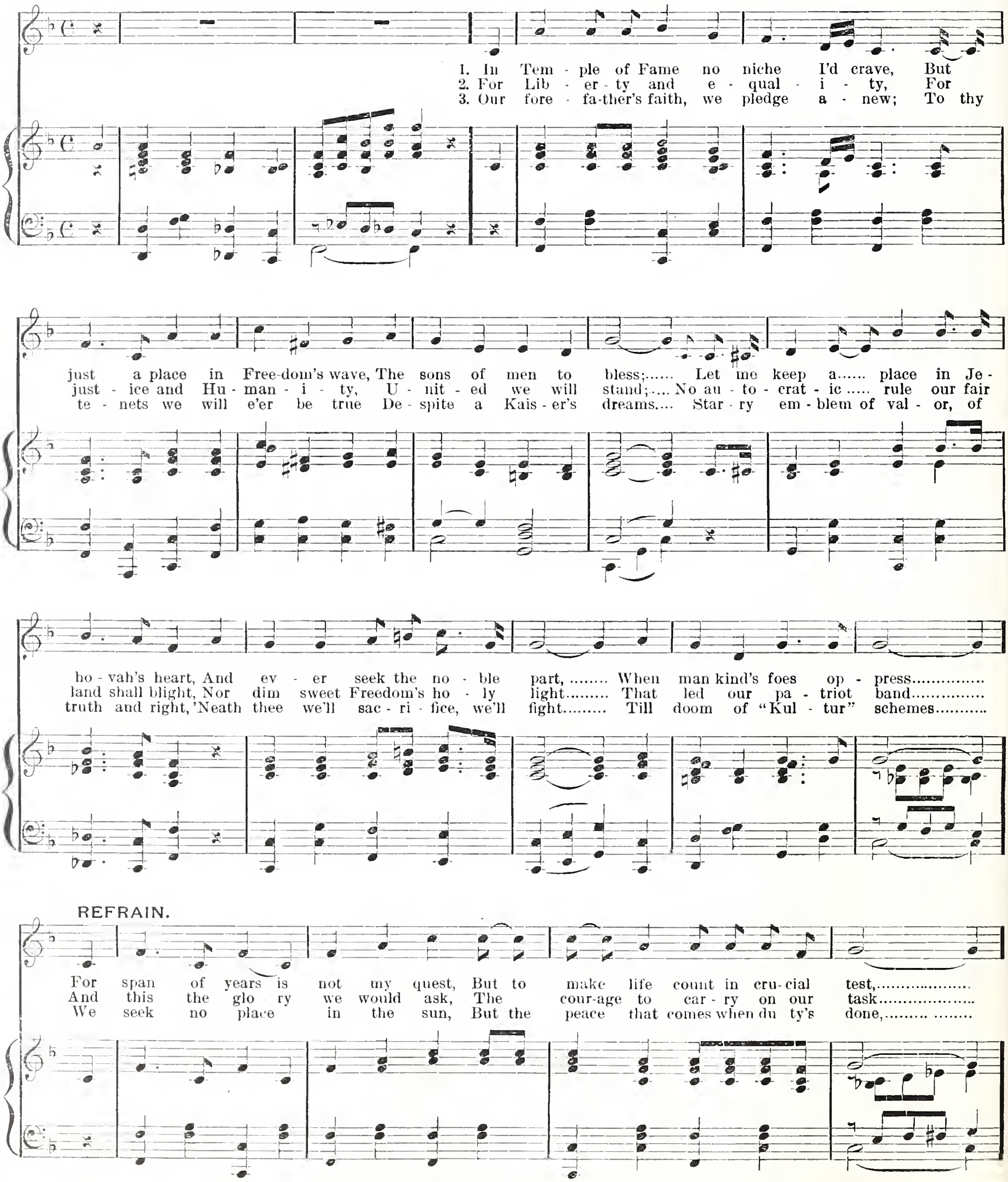
JOHN S. HOPPES, Harrisburg, Pa.
AUTHOR AND PUBLISHER

ALL RIGHTS RESERVED

American Publisher's profits on this song given to
THE AMERICAN RED CROSS SOCIETY

FREEDOM'S SONG.

Words and Music by JOHN S. HOPPES.


1. In Tem - ple of Fame no niche I'd crave, But
2. For Lib - er - ty and e - qual - i - ty, For
3. Our fore - fa-ther's faith, we pledge a - new; To thy
just a place in Free-dom's wave, The sons of men to bless;...... Let me keep a...... place in Je -
just - ice and Hu - man - i - ty, U - nit - ed we will stand;.... No au - to - crat - ic..... rule our fair
te - nets we will e'er be true De - spite a Kais - er's dreams.... Star - ry em - blem of val - or, of
ho - vah's heart, And ev - er seek the no - ble part, ... When man kind's foes op - press..............
land shall blight, Nor dim sweet Freedom's ho - ly light......... That led our pa - triot band...............
truth and right, 'Neath thee we'll sac - ri - fice, we'll fight......... Till doom of "Kul - tur" schemes..........
REFRAIN.
For span of years is not my quest, But to make life count in cru-cial test,....................
And this the glo - ry we would ask, The cour-age to car - ry on our task....................
We seek no place in the sun, But the peace that comes when du - ty's done,......... ....

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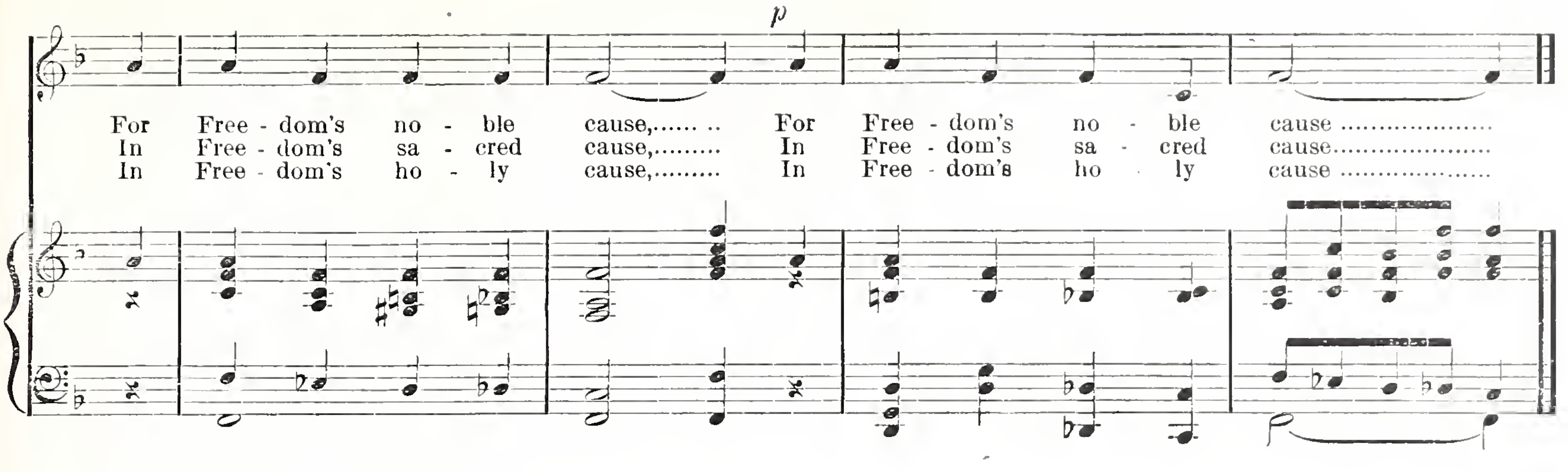
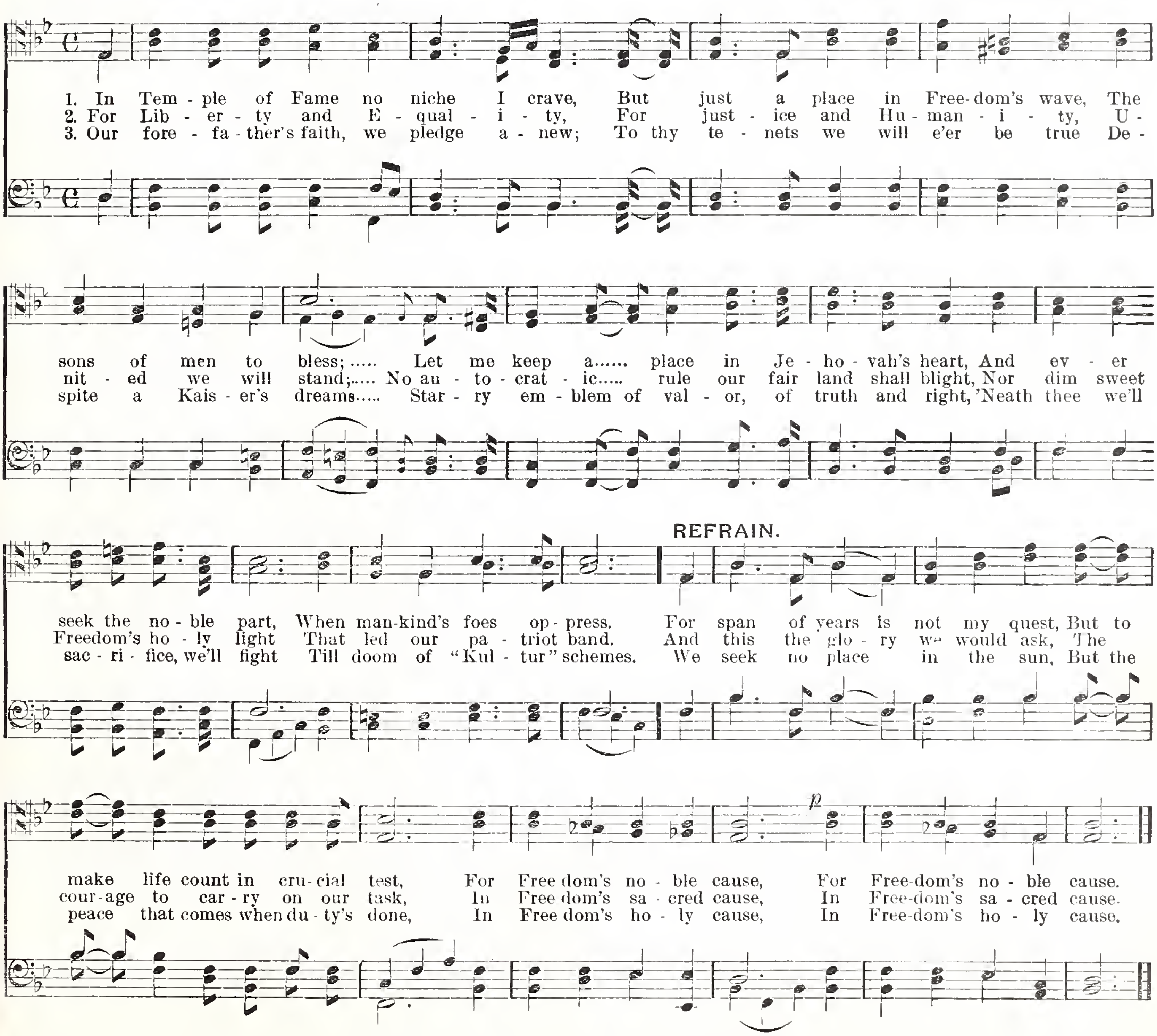

p
For Free - dom's no - ble cause,....... For Free - dom's no - ble cause ....
In Free - dom's sa - cred cause,......... In Free - dom's sa - cred cause.....................
In Free - dom's ho - ly cause,......... In Free - dom's ho - ly cause ....

FREEDOM'S SONG.

Male Voice arr.

Words and Music by JOHN S. HOPPES.


1. In Tem - ple of Fame no niche I crave, But just a place in Free - dom's wave, The
2. For Lib - er - ty and E - qual - i - ty, For just - ice and Hu - man - i - ty, U -
3. Our fore - fa - ther's faith, we pledge a - new; To thy te - nets we will e'er be true De -
sons of men to bless;..... Let me keep a...... place in Je - ho - vah's heart, And ev - er
nit - ed we will stand;..... No au - to - crat - ic..... rule our fair land shall blight, Nor dim sweet
spite a Kais - er's dreams..... Star - ry em - blem of val - or, of truth and right, 'Neath thee we'll
REFRAIN.
seek the no - ble part, When man-kind's foes op - press. For span of years is not my quest, But to
Freedom's ho - ly light That led our pa - triot band. And this the glo - ry we would ask, The
sac - ri - fice, we'll fight Till doom of "Kul - tur" schemes. We seek no place in the sun, But the
make life count in cru - cial test, For Free dom's no - ble cause, For Free-dom's no - ble cause.
cour - age to car - ry on our task, In Free dom's sa - cred cause, In Free-dom's sa - cred cause.
peace that comes when du - ty's done, In Free dom's ho - ly cause, In Free-dom's ho - ly cause.
p

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FOURTH SUPPLEMENT

TO

The London Gazette

Of TUESDAY, the 2nd of APRIL, 1918.

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FRIDAY, 5 APRIL, 1918.

War Office,
5th April, 1918.

The Secretary of State for War has received the following Despatch from Lieutenant-General Sir J. L. van Deventer, K.C.B., Commanding-in-Chief British Forces in East Africa:—

Dar-es-Salaam,
21st January, 1918.

My Lord,

I have the honour to forward herewith my Despatch on the operations of the forces in East Africa from 30th May to 1st December, 1917.

In accordance with your Lordship's instructions I left Pretoria on 15th May, and took over the command in East Africa from General Hoskins in Dar-es-Salaam at noon on the 29th May.

At that time the enemy's forces were in two main bodies. The Western force, commanded by Tafel, was based on Mahenge. It consisted of between 2,000 and 3,000 men, and held the country to a radius of about 70 miles to the west, north and east of Mahenge, with a strong detachment at Likuju, fifty miles from Songea, on the Songea-Liwale road.

The Eastern (and main) German force was in the coastal area, facing our troops at Kilwa and Lindi. Its strength was between four and five thousand, and included the pick of Von Lettow Vorbeck's troops, under the direct command of the German Commander-in-Chief.

In addition to the above, there were two important detachments. One of four or five companies under Von Stuemer, had invaded Portuguese East Africa, and was exploiting the rich Mwembe area lying between the Lujenda River and Lake Nyassa. The other, of 600 men under Naumann, which was more a raiding force than a detachment, had succeeded in evading our pursuing troops and crossing the Central Railway east of Tabora; it was now moving northwards.

Our own troops were disposed as follows:

At Lindi, one brigade under General O'Grady.

Between Kilwa and Mohoro, and holding the country for thirty-forty miles inland, two columns under General Hannyngton.

On the Rufiji at Kibambawe, the Nigerian Brigade (less one battalion) under General Cunliffe.

Pursuing Naumann, the equivalent of a brigade, with an equal number of our Belgian Allies.

Two battalions were at Iringa, and a small central reserve at Morogoro.

General Northey's force held a line from Ubena to Songea, while a detachment consisting of a battalion of the King's African Rifles was pressing northwards from Fort Johnston, in Nyasaland, against Von Stuemer.

2. The health of our troops, after the wettest season known in German East Africa for very many years, was far from good. None but the indigenous African can stand the climate of the coastal belt in the rains, and the conditions on the banks of the Rufiji were but little better. Europeans, Indians, and Africans recruited from any but low-lying areas had alike suffered terribly from malaria; the "paper strengths" of the force bore no relation whatever to the numbers of men actually available in the field; and a brigade that could put 1,400 rifles into the firing line considered itself singularly fortunate. Iringa, and the Ubena-Songea area, were, however, comparatively healthy; and Northey's troops, though war-worn, were far fitter than those on the coast.

3. It was evident that the forthcoming operations would differ considerably in character from those of the earlier parts of the campaign. With the possible exception of Mahenge, and certain food areas, there were no strategical objectives such as had been offered by the Moshi area, the Tanga and Central Railways, Tabora, or Dar-es-Salaam. The country now held by the enemy was, for the most part, wild and inhospitable; means of communication were practically non-existent; and even the better known places, such as Liwale and Massassi, were, from a military point of veiw, mere geographical expressions. It therefore became obvious to me, at a very early stage, that our true objectives in the coming campaign must be the enemy forces in the field, and that the completion of the conquest of German East Africa could only be brought about by hard hitting, and plenty of it.

The campaign promised to be one of considerable difficulty. The enemy still occupied a territory over 300 miles square, and had the immense advantage of interior lines. From Mahenge to Liwale was merely a seven-day march for his Western force, but the transfer of a British force from Mahenge to Kilwa or Lindi, whence alone Liwale could be reached, would have taken as many weeks. The country was admirably suited to defence and to rear-guard tactics. The enemy's askaris were now all veterans and fighting in their native bush, backed by the numerous and well-handled German machine guns, were worthy opponents for the best troops.

It was evident that the enemy's chief object was to play for time; to keep the net from closing on him, and to hold out in German East Africa, if possible, till the next wet season, hoping that the rains would then prevent our maintaining the long lines of communication that would be necessary before we brought him to bay. His hopes were doubtless raised by the abnormal rainy season that had just come to an end, for much of the country was still water-logged, and could not be fit for mechanical transport for some time, and thus the period available for active operations was considerably reduced.

Moreover, the pursuit of Naumann was diverting valuable troops from the main operations, and, owing to shipping difficulties, both transport and reinforcements were arriving slowly.

4. There were five possible lines of advance from the north and east—

(*a*) Dodoma-Iringa-Mahenge. — The healthiest but also the longest. The country between the highlands of Iringa and Mahenge was difficult, and only a small portion of it could be made possible for motor transport.

(*b*) Kilossa-Kidatu-Mahenge.—A shorter line than the first, and more feasible for motor transport. Both (*a*) and (*b*) suffered, however, from the defect that the rainy season in this area is considerably earlier than on the coast, and the Ruaha and Kilombero rivers might become very formidable obstacles early in December.

(*c*) Mikesse-Kibambawe-Mahenge. — The most difficult as regards physical obstacles. The Mikesse-Kibambawe line had given much anxiety in the beginning of January, 1917, and the country south of Kibambawe was a wild tangle of bush, totally impracticable for wheels.

(*d*) Kilwa.—The unhealthiest of all. But a large proportion of the enemy's forces were within close striking distance of Kilwa, and it was possible that the health conditions here and at Lindi might improve with the advent of the dry weather. Kilwa also possessed a first-class harbour, accessible to ships of all but the largest tonnage.

(*e*) Lindi.—It was obvious that this line would, sooner or later, assume very great importance. For it was only by a thrust south-westwards towards Massassi that we could hope to cut off the main enemy force from Portuguese East Africa. Lindi Harbour had, however, considerable limitations, and could only be used by a proportion of the shipping at our disposal, while the country between Lindi and Massassi was extremely thick and difficult.

5. Taking all the above factors into consideration I decided to make my main advance from Kilwa and Lindi; to operate against the enemy in the Mahenge area from both Dodoma and Kilossa, and to use General Northey's forces to assist in the Mahenge operations to clear Von Stuemer out of Portuguese East Africa, and finally to advance towards Liwale from Songea.

It was also very necessary to get rid of Naumann. It seemed that the quickest way to do this would be by the employment of mounted troops, and a request was sent to the Union Government that a regiment should be raised for this purpose, and for use thereafter against the enemy's main forces.

6. Much preparation was necessary before the main operations could commence, but certain subsidiary operations appeared immediately feasible.

It was very desirable to clear a larger area round Lindi in order to secure a better water supply and to prepare the main exits from the town and harbour. It was also desirable to eject the enemy from the upper part of the Ulanga (or Kilombero) Valley, and to advance towards Ifakaras, as such a move was calculated to make the enemy weaken on the line of the Ruaha at Kidatu, and so facilitate the advance on Mahenge from Kilossa.

I decided that these two operations could be begun at once, and that at the end of June the state of reinforcements and transport at Kilwa would probably permit me to begin operations in that area against the enemy's main force. Meanwhile General Northey would be concentrating at Songea for his advance eastwards, and his troops in Portuguese East Africa would continue clearing the enemy out of the country they had occupied.

The operations under General Edwards against Naumann were in full progress north of the Central Railway.

7. During June the situation developed on the above lines with varying results.

On the west General Northey despatched the 1/4th King's African Rifles to clear the enemy from the district east of Lake Nyassa. Half this battalion crossed the Portuguese border north of Fort Johnston and moved northwards, being joined later by the remainder of the battalion, which was landed on the shore of Lake Nyassa, to the south-west of Mtonia. By the end of June this force had advanced to within a day's march of Mwembe, where enemy patrols were encountered. Mwembe and Likopolwe were both occupied by 6th July, the enemy falling back northwards without serious resistance.

The Songea column, consisting of 1/1st and 2/1st K.A.R., 1st South African Rifles, and a section of Mountain Artillery, had by 30th June completed its concentration at Likuju, on the Songea-Liwale road. The enemy were unaware of the extent of this concentration, and on the 29th approached Likuju with about five companies, and opened fire on the camp with a field gun, but thereafter made off hurriedly without attempting further reconnaissance.

Two companies of Northern Rhodesian Police were despatched on 27th from Lupembe to Nalugombe to prevent the enemy at Mpepo from reinforcing his Ruipa front.

Colonel Tytler concentrated the Iringa column, consisting of the 17th Infantry, 2/4th K.A.R., and two sections 24th Mountain Battery, at Boma Mzinga by 29th June, with advanced posts forward to Mgeta Mission, and improved the roads for his advance to Ifakaras, which began on the 30th.

The situation in the Kilwa area during June was as follows:—

The enemy was holding a general line running from Kimamba Hill, adjoining Kisiwani Harbour, up the right bank of the Ngaura River to Makangaga, and thence across to Kilaganeli, eight miles south of Kirongo, and to Nahende, on the Liwale road. Kimamba Hill, the rising ground opposite Rumbo, Kilaganeli, and Nahende were held by strong detachments. A total of eighteen companies was known to be on this front, of which about eleven were between Kimamba Hill and Makangaga. There were also two or three enemy companies to the north-west at Madaba, which sent constant patrols eastward.

The composition of the Kilwa force (temporarily under command of Brigadier-General Beves) was as follows:—

No. 1 Column (Colonel Orr).

33rd Punjabis.
Gold Coast Regiment.
2/2nd K.A.R.
2nd Mountain Battery.

No. 2 Column (Colonel Grant).

57th Rifles.
129th Baluchis.
1/3rd K.A.R.
2/3rd K.A.R.
11th Hull Heavy Battery.
27th Mountain Battery.

No. 2 Column was concentrated at Kirongo, with detachments at Namatewa, Chemera, and Mnasi, No. 1 Column at Rumbo, with a strong detachment opposite Kimamba Hill, and a smaller intervening detachment.

Throughout the month our patrols were in daily touch with enemy patrols, which devoted much attention to harassing our lines of communication. Careful reconnaissances of the enemy's positions opposite Kirongo, Mnasi, and Rumbo were undertaken, and preparations made for attack on the arrival of reinforcements. These arrived at the end of the month, the 8th South African Infantry being allotted to No. 1 Column, and 7th South African Infantry and one company 3/3rd K.A.R. to No. 2 Column. A small colmun, No. 3, consisting of 3/3rd K.A.R. (less one company) and 200 rifles 40th Pathans, was formed under Colonel Taylor.

On the 27th the enemy evacuated some of his advanced positions, and on the 28th patrols found that all had been given up, except Kimamba Hill, which was held by a light rearguard until the morning of the 29th, when our troops drove it off.

Intelligence and patrolling indicated that the enemy had withdrawn in the direction of Mtshakama, while still maintaining his detachment at Kilaganeli.

In the Lindi area the first week of the month was spent in active reconnaissance and preparation for an operation to expel the enemy from the area Ngapa-Schaeffer's Farm-Mayani, which he was holding with about six companies. On the 10th June the Lindi force advanced in two columns, the right column (5th Infantry, 1/2nd K.A.R., half 259th Machine Gun Company, one section 27th Mountain Battery, under Lieutenant-Colonel Law, 2nd West India Regiment) moving from Lindi via Naitiwi and Mayani, while the main column (25th Royal Fusiliers, 3/2nd K.A.R., Machine Gun Section and Trench Mortars of 2nd West India Regiment, one section 3rd Battery South African Field Artillery, one company 61st Pioneers, under Brigadier-General O'Grady) operated to the east of Mandawa from Mkwaya Creek, where a successful landing was carried out in co-operation with the Navy, which also supported the advance of the main column by covering fire. The operation was completed by the 13th June, the enemy abandoning the area after some resistance, in the course of which the 25th Royal Fusiliers took two machine guns.

The abandoned area was occupied by our troops, and active patrolling forward was carried out till the end of the month. On the 29th the Officer Commanding at Naitiwi (Lieutenant-Colonel Wilford, D.S.O., 5th

Light Infantry) hearing of a small enemy party near Lutende, some eight miles north of his post, moved out with 150 rifles of his battalion to attack it. The enemy camp was rushed at dawn on the 30th, three white and several black prisoners being captured. Our force was, however, almost immediately counter-attacked by three enemy companies, whose presence had not been suspected, and surrounded. Colonel Wilford was mortally wounded early in the engagement. Captain Hall took command, and, after a gallant fight against very heavy odds, finally broke out with some fifty men and reached Naitiwi.

8. Active operations took place during June north of the Central Railway, where British and Belgian columns continued the pursuit of Naumann.

As the country to the west of Mwanza was familiar to the enemy, and he had made persistent efforts to break in that direction, General Edwards disposed his columns to prevent such a movement, while he continued to pursue from the south. Naumann kept on moving northwards, and on the 5th June attacked our post at Mkalama, which was gallantly defended by its small garrison of five whites and twenty-two Askaris, under the Political Officer, Captain Holland, until the arrival of our column on the 8th. The enemy resumed his march, crossed the Sibiti River, and then turned north-west, with the intention of breaking west between Schinyanga and Ilola. On finding, however, that this path was barred, he turned north again, and, crossing the Simiju River on the 15th, reached Samanda on the 17th June, evidently making for Ikoma.

9. I had a meeting at Dodoma on 18th June with Colonel Huyghe, the Belgian Commander-in-Chief, and we agreed that the force engaged in pursuing Naumann was too large, that a smaller force could be given more mobility, and that this should be homogeneous. It was therefore decided that the Belgian troops should take over the Naumann operations from 25th June.

I further asked Colonel Huyghe to send a Belgian column from Dodoma via Iringa to operate against the enemy on the Malinje-Mpepo front, and arranged with him that, during July, another strong column should be got ready to act from Kilossa through Kikumi and Kidodi towards Mahenge. Thus the Belgian forces would eventually be in a position to take over the Mahenge operations entirely.

10. During July General Northey's columns made good progress at all points. In Portuguese East Africa the 1/4th K.A.R. advanced steadily north-eastwards, driving back the enemy, and by the end of the month had completely cleared the north-west portion of Portuguese East Africa. On the 31st the 1/4th K.A.R. crossed the Rovuma on rafts near Sassawara unopposed, and moved on Tunduru.

The Songea column, which had concentrated at Likuju, advanced on the 3rd July, and by the 7th had driven the enemy from his position covering the Songea-Liwale and Songea-Mahenge road junction. The opposing enemy force did not retire towards Liwale, as we had expected, but drew off northwards in the direction of Mahenge; and I directed General Northey to pursue if necessary as far as Mpondas, when the situation would be reconsidered. This advance continued steadily, the enemy force of about five companies, though offering a stubborn rearguard resistance in difficult country, being driven from position to position, until, at the end of the month, Colonel Hawthorn had reached a point a few miles south of Mpondas. There were signs that the enemy had been reinforced from Madaba in the Eastern Rufiji area.

Further north two small columns from Lupembe, under Lieutenant-Colonel Fair, had similarly pressed the enemy's detachment to the west of Ruhudje, and by the 26th had driven the whole of it across that river into the Mpepo Mkapira area.

The Iringa column by 2nd July had its advanced troops in contact with the enemy on the Ruipa River, and by the 7th had secured a crossing. The advance continued against constant rearguard opposition, and by the 15th the column had occupied the whole of the entrenched enemy positions on the Ruipa. The enemy fell back on a strong position on the Njarabungu River, our forces following slowly on account of transport difficulties in rear. On the 29th July the enemy was attacked in position and compelled to withdraw towards the Idete River.

11. The effect of the above operations on the Western front was clearly shown by the way in which the enemy withdrew his forces from other points in order to strengthen the Mahenge area. To the north he began to fall back to the line of the Ruaha River, while further east he weakened his forces at Madaba, sending the bulk of them to reinforce his troops on the west. This latter movement eventually enabled me to reduce my detachment on the Lower Rufiji to one battalion, which carried out active patrolling to the south, with the object of inducing the enemy to anticipate an advance on our part from the Rufiji.

12. Important operations took place during July in the Kilwa area, where I found myself in a position to initiate operations against the enemy's main forces during the first week of the month.

Transport considerations did not yet permit of these operations being pressed beyond a limited distance, but I hoped that I should be able to go far enough to compel the enemy to show definitely whether he intended to retire towards Liwale or Massassi, to gain ground in which roads and water supplies could be prepared for the next step, and to inflict loss on the enemy which would weaken his resistance to subsequent blows.

With these objects in view I decided, as a first phase, to drive the Kilwa enemy south of the Kiturika Hills. The Lindi force was meantime to contain the enemy opposing it, but to take no offensive on a large scale pending arrival of reinforcements.

The advance at Kilwa began on 5th July with a converging movement of Nos. 1 and 2 Columns of the Kilwa force against the enemy positions round Mnindi, on the Mtshakama road, while No. 3 Column moved simultaneously from Wungwi, on the western shore of Kisiwani Harbour, towards Nambanditi.

There was sharp fighting during the whole of the 6th, No. 1 Column driving the enemy from a position four miles north-east of Mnindi and pressing him backwards, while No. 2 Column attacked Mnindi from the west. The enemy was found well entrenched on both fronts, and the attacks progressed slowly. Towards evening the enemy delivered a heavy counter-attack with the bulk of his force against No. 2 Column, in which he suffered considerable loss, but regained ground which enabled him to keep open the Mtshakama road and retire by it during the night. No. 3 Column reached Nambanditi without opposition.

The left and centre columns (Nos. 3 and 1) continued their advance directly towards Mtshakama, while the right column (No. 2) moved via Kirongo against the three or four enemy companies at Kilaganeli. These retired south and were followed up, slight rearguard resistance being encountered at Mtandawala on the 14th. A concerted attack on Mtshakama by all three columns was designed, but the enemy did not await this blow, and continued his movement southwards. No. 2 Column was thereupon directed on Likawaje, Nos. 1 and 3 Columns on Narungombe. The two latter encountered rearguard opposition on the 17th and 18th, and by nightfall on the 18th had reached a point two miles north of Narungombe, which was reported to be held in force. No. 2 Column was thereupon directed to co-operate in an attack on Narungombe on the following day.

The allotment of troops to the columns had varied during the advance in accordance with the tactical situation, and on the 18th was as follows: —

No. 1 Column (Colonel Orr).

8th South African Infantry (less two companies).
Gold Coast Regiment.
33rd Punjabis.
2/2nd K.A.R.
27th Mountain Battery.

No. 2 Column (Colonel Ridgway).

7th South African Infantry.
1/3rd K.A.R.
2/3rd K.A.R.
22nd Mountain Battery.

No. 3 Column (Colonel Taylor).

8th South African Infantry (two companies).
3/3rd K.A.R. (less one company).
40th Pathans (detachment).

Early on the 19th No. 1 Column gained touch with the enemy and engaged him in front, while Nos. 2 and 3 Columns moved against his left and right flanks respectively. The enemy was found to be strongly entrenched and the fighting was particularly severe. In the centre the 33rd Punjabis and Gold Coast Regiment succeeded in capturing the enemy trenches in front of No. 1 Column, but were heavily counter-attacked, and finally compelled to exacuate them after a stubborn resistance. On the left bush fires greatly interfered with the movements of No. 3 Column. The enemy took advantage of this to launch heavy counter-attacks against No. 3 Column, and the detachment of the 40th Pathans on the extreme left, which quickly lost all its British officers killed or wounded, was forced back. The remainder of the column, which was in imminent danger of being rolled up, was compelled to give ground.

Meanwhile on the right No. 2 Column had gained a position well round the enemy's left flank, repelling three counter-attacks, and by the afternoon was pressing the enemy closely. In order to relieve this pressure the German Commander made another strong counter-attack, which was stopped, and in turn counter-attacked by the 1/3rd K.A.R. under Major Durham. The enemy was driven back right through the trenches on his left flank, which were taken and firmly held.

This success decided the action, the enemy evacuating the whole of his position at dark and retiring towards Mihambia. His losses had been heavy.

The 22nd and 27th Mountain Batteries and Gold Coast Battery gave close support throughout the day to the attacking infantry, whose gallantry and endurance were most marked. The casualties, particularly amongst officers, had been considerable in nearly all units engaged.

The occupation of Narungombe practically completed the clearing of the Kiturika Hills, which had been an arduous task for the troops engaged. The effective fighting strength of the Kilwa force had been greatly depleted by malaria and other sickness, and rest and reinforcements were necessary before the advance could be resumed.

At Lindi the month passed quietly in reconnaissance, and preparation for an advance early in August.

13. While progress was thus being made in the main operations, Naumann remained north of the Central Railway, and by his activities threatened to prove a serious nuisance.

It was never possible to forecast his intentions, as his detachment, though a sufficiently effective fighting force of 600 rifles, twelve maxims, and two guns, was completely mobile and small enough to live on the country. On the 28th June he captured Fort Ikoma, a small post east of Lake Victoria, garrisoned by a few irregulars. The Belgian pursuing column reached Ikoma the following day, and had a sharp engagement with the enemy, who thereafter turned eastwards towards Lake Natron. This movement necessitated my taking steps to garrison the Magadi and Aruscha Districts, troops for the purpose having either to be taken from my reserve or from new K.A.R. battalions under training.

Naumann passed through the Sonjo district and then moved in a south-east direction, reaching Engaruka on the 17th, his objective then appearing to be Aruscha. A mobile Belgian column left Ikoma on the 20th with the object of forcing him southwards towards the Central Railway. On that day Naumann was on the north shore of Lake Manyara, and was reported to be making for Kondoa. The Cape Corps, from Aruscha, was directed to join in the pursuit. The enemy passed through Ufiome and Massogoloda, leaving the latter place on the 25th, and moved southwards east of Mount Hanang, with the apparent intention of recrossing the railway.

I arranged with Colonel Huyghe that the Belgian troops should endeavour to drive Naumann south on to the railway near Dodoma, where my reserve column could engage him, and at the same time I reinforced Kondoa and made preparations to deal with a possible move to the east.

14. The general situation at the beginning of August had cleared up considerably. The enemy had been driven out of Portuguese East Africa, and on the western front had been pressed back to the general line Kidatu-Idete River-Mpepo-Mpondas. On the eastern front he had been compelled to withdraw from the

Lower Rufiji area and had been forced out of the Kiturika Hills.

It had been found, however, that the enemy's capacity for resistance had not been in any way weakened by the rainy season, and that the moral and training of his troops remained high. There was thus every reason to expect that there would be serious opposition in the coming stages when the circle round him began to tighten.

I decided to continue operations on the same lines until the arrival of reinforcements and transport should place me in a position to make an uninterrupted advance against the main enemy and deal him a decisive blow. This, I estimated, would be about the middle of September.

15. During August and the early part of September good progress was made in the West. Lieutenant-Colonel Shorthose, after crossing the Rovuma, continued his movement north and occupied Tunduru on 23rd August after slight opposition, thus firmly establishing our hold on this district, which was of considerable supply importance.

The Songea column, under Colonel Hawthorn, remained in the vicinity of Mpondas, engaged in a constant struggle, in the most difficult ravine country, with an enemy of equal strength, who received frequent minor reinforcements. Colonel Hawthorn continued to operate with enterprise and vigour, manœuvring the enemy out of successive positions and inflicting loss on him in many minor engagements.

The Lupembe column, under Lieutenant-Colonel Fair, forced back the enemy to the Mpepo area, and by the 20th August was hemming in the enemy detachment there, which finally gave way and retired towards the east. Our troops followed in close pursuit, and on the 30th inflicted a severe local defeat on the enemy, killing or capturing three white and 92 askaris.

The Iringa column was reinforced on 10th August by the leading troops of the Northern Belgian Column. This latter column had been originally intended to operate in the Malinje-Mpepo area, but on account of the progress of our own troops in that area it had been diverted to the Ruipa front, and I arranged with Colonel Huyghe that it should ultimately replace my Iringa column, and so leave the zone of operations towards Mahenge entirely in Belgian hands.

The combined forces under Colonel Tytler renewed operations against the enemy on the Idete River, and by the 26th had effected a crossing and were pushing patrols towards Ifakaras.

Meanwhile the main Belgian column (Southern) had been concentrating at Kilossa and Uleia, and on the 14th began its move south against Mahenge. The enemy did not offer serious resistance to the earlier stages of this advance, and the column moved rapidly forward, driving in the opposing rear-guards and capturing prisoners. By the 26th the column had reached Kiberege, and by the 28th had joined hands at Ifakaras with the Belgian Northern column, and the Iringa column. The latter column was then withdrawn, the 2/4th K.A.R. being sent to reinforce General Northey, while the remainder returned to the Central Railway in reserve.

The enemy had retired south of the Kilombero River, which was a formidable obstacle, but the rapidity and skill with which the Belgian columns acted deprived the enemy of any advantage he might have gained from this. By the 6th September the Belgian columns had secured crossings at two places, and by the 8th the whole of the Belgian Southern Brigade was across and moving against Mahenge. The enemy opposition now became greater, and strong resistance was encountered at Kalimoto on the 11th, from which date the enemy disputed every foot of the way into Mahenge, through hilly country, densely bushed. Progress was necessarily slow, but remained steady, and by the end of September the Belgians, after numerous successful encounters, had reached a point seven miles north of Mahenge and were encircling it from both east and west.

16. On the Eastern front active patrolling was carried out in the Kilwa area with one or two minor encounters, but the chief effort was devoted to organisation and preparation for the advance in mid-September. The tram line was extended as rapidly as possible towards the south, roads improved, transport collected and supplies accumulated as far forward as possible. By the end of the first week in September the bulk of the Nigerian Brigade and the new Indian reinforcements (55th Rifles, 127th Baluchis, and 25th Cavalry) had been landed and were nearly ready to take the field.

The enemy had reinforced his Kilwa front at the end of July, and as this could only have been done at the expense either of his Lindi front or of his reserves, I decided to push forward in the Lindi area during August and thus improve my position for vigorous action against the enemy should he retreat into the Massassi area.

On the 2nd August the Lindi force began operations by occupying the enemy's forward position on the Mohambika stream, and on the 3rd advanced in three columns against his main positions from Tandamuti Hill to Mandawa. The right column (3/2nd K.A.R.) advancing from Schaedels reached its objective, driving the enemy from his advanced position east of the loop on the trolley line. The objective of the left or main column (25th Royal Fusiliers, 259th Machine Gun Company, 3/4th K.A.R.) was the enemy's right flank on Tandamuti Hill. Here very stubborn resistance was encountered, the centre of which was a concealed redoubt, the existence of which was not previously known. Despite repeated efforts this redoubt could not be taken, and in consequence the main column was brought to a standstill. The centre column (30th Punjabis) became thus unsupported in its advance, and on being heavily counter-attacked by the enemy's reserve was compelled to withdraw with considerable loss after the whole of the British officers had become casualties. The engagement ended by our troops entrenching on the ground gained and organising for a fresh advance.

This began on the 10th by a turning movement south of Tandamuti Hill, which was heavily bombarded by the Navy with the object of deceiving the enemy as to the point of attack. The movement was successful in causing the enemy to abandon his ground and fall back to another strong position at Nurunyu. General O'Grady followed in pursuit, keeping in close contact with the enemy and reconnoitring actively with patrols. Heavy rain hindered operations on the 15th and 16th, but on the 18th the enemy was closely engaged and pressed back to his main line of defence at Nurunyu, opposite to which our troops entrenched.

Active reconnaissance was carried out on the 19th in preparation for attack, but in view of reliable information that the enemy had received considerable reinforcements from the north, I did not consider it advisable to press the Lindi offensive further at the time, and decided to confine action in that area to active patrolling and to organisation and preparation until the Kilwa force should be ready to move.

17. The attempt at the end of July to drive Naumann south on to the Central Railway had not been successful. In the early days of August he succedeed in evading our troops on the Kondoa-Dodoma line by night marches through thick bush, and broke out with his main force eastwards towards Luita. As this movement brought him beyond the reach of the Belgian troops, these were withdrawn, and the pursuit taken up by a column under Colonel Dyke, consisting of the 1st Battalion, Cape Corps and King's African Rifles Mounted Infantry, gradually reinforced by the 10th South African Horse, as that regiment completed its mobilisation. One Nigerian battalion was also temporarily attached to this column.

Reports first indicated that he was making for Handeni, and I formed a small mobile column of King's African Rifles at Korogwe to meet this move. On the 13th information was received that Naumann was moving south from Luita towards the railway, and our troops moved to intercept him. Finding himself headed off, he moved east towards the Nguru Hills, closely pursued by our troops, which now included part of the 10th South African Horse. Naumann had now divided into three parties, and reports became in consequence very conflicting; but by the 21st it was evident that his main force was moving north again, via the Masai Steppe, while one party still remained west of the Nguru Hills, in the vicinity of Kakera. This latter party was at once closed on by our troops, and surrendered on 2nd September, nine whites and about 100 Askaris, with many porters, being made prisoners. Naumann with his main body crossed the Masai Steppe, and on the 29th one of his raiding parties held up a train near Kahe, while his third party, keeping more to the west, headed for Engaruka and Massogoloda.

A day or two later reports were received that Naumann had given up his move north and was doubling back south across the Masai Steppe. During the previous few weeks minor captures from his force had been frequent, and it was evident that it was being gradually destroyed and that the end could not be far off. He reached Kidschungo on the 8th September, and thence made south towards the Nguru Hills, with our troops closing in from all sides. The 1st Battalion Cape Corps, under Lieutenant-Colonel Morris, which had done much hard marching during the pursuit, closed in from north, north-west and west, while another portion of the battalion, which had been previously detached, closed in from the east and south-east. Both these detachments were accompanied by troops of the King's African Rifles Mounted Infantry, which had clung close to the enemy throughout. The column of King's African Rifles based on Korogwe closed in from the north-east, while the 10th South African Horse advanced from the south-west and south. On the 15th Naumann reached Geiro, but found his way blocked by the cavalry. He then turned north again with the 10th South African Horse in close pursuit, and was finally brought to bay on the Luita Hill, a very strong natural position. The 10th South African Horse occupied all surrounding water-holes, and kept Naumann's force in play until the arrival of the infantry. Naumann was then closely invested, and surrendered on 1st October, together with fourteen other German whites, 165 Askaris and many porters.

The remaining party of Naumann's force had meanwhile continued to move west to Lake Eyassi, where it halted. This party was of small strength, and on October 2nd surrendered to a detachment of King's African Rifles sent from Aruscha. Three whites and fifty-three Askaris were made prisoners.

Thus ended a remarkable raid. The force which carried it out was composed of first-class Askaris, well led. It started under Wintgens from Gumbiro, sixty miles north-west of Songea, in the beginning of February. New Langenburg and Bismarksburg were threatened in turn; the force then turned northwards and passed through Itunda, leaving the German Commander in our hands there, sick. Naumann succeeded, and crossed the Central Railway east of Tabora on 27th May, marching north. Repulsed at Mkalama, and prevented from breaking westwards, Naumann went north again, heavily engaged the Belgians at Ikoma, after which he moved westwards towards the Magadi Lake, then south of Kondoa Irangi, near which place he narrowly escaped capture. After threatening Handeni, he was next heard of near Moshi. Finding our troops ready for him there, he doubled back on his tracks, re-crossed the Kondoa Irangi-Handeni road and was finally brought to bay.

Such a raid could perhaps only have been carried out in a country like German East Africa, where the bush is often so thick that two considerable forces may pass within a mile, unaware of each other's presence; and where a ruthless leader of a small force can nearly always live on the country.

18. By the middle of September the situation was ripe for the main advance. The Kilwa force had been strengthened by the bulk of the Nigerian Brigade, the 25th Indian Cavalry, and two Indian Battalions, the 55th Rifles and 127th Baluchis. The Lindi force had also been increased, and was organised in two main columns, Nos. 3 and 4. Sufficient motor transport was by this time available for the whole force.

My plan was to make a combined movement southwards from the Kilwa area, and south-westwards from Lindi, engaging the enemy wherever met with.

I hoped thus to be able to deal with the enemy main force, whatever course it might take. If it went westwards towards the Liwale Mahenge area, the Kilwa force could be diverted in that direction, while the Lindi force occupied Massassi and cut off retreat to the south. If it stood to fight against the Kilwa force, the Lindi force would come in against its flank and rear. If it were divided against the Kilwa or Lindi forces, or opposed mainly to the latter, then the Kilwa force was strong enough to press back anything that might oppose it, and attack the flank or rear of the portion opposing the Lindi troops.

Meanwhile the western forces were to press on vigorously and keep all enemy troops in the Mahenge area fully contained.

19. I proceeded to my Advanced Headquarters in the Kilwa area on 10th September, and the move forward of the Kilwa force began on the 19th, when No. 1 Column from Narungombe drove the enemy out of Mihambia after sharp fighting. No. 2 Column moved from near Mssindy against Ndessa, from which the enemy withdrew after slight resistance, and the Nigerian Brigade on the right moved from Mssindy by a circuitous route against Mawarenye, to try and cut off the enemy's retirement.

The 25th Cavalry were despatched on a special mission to destroy the enemy food depôts at Nangano, and on the Mbemkuru between there and Nahungu.

The advance continued steadily on the 20th and 21st, the enemy's Ndessa force falling back before Nos. 1 and 2 Columns. It had not, however, located the movement of the Nigerians, and, on the 22nd, it attempted to retire south-west from Mawarenye by a road which two battalions of the Nigerian Brigade under General Cunliffe had already gained possession of. The enemy made desperate efforts to break through, which were all repulsed with heavy loss, and finally he was compelled to retire hastily in small parties southwards through the bush, leaving over 100 dead on the ground.

The three columns continued their movement southwards, meeting with constant opposition. No. 2 Column occupied Mawarenye on the 23rd, sent the 2/3rd K.A.R. to reinforce the Nigerian Brigade for the advance on Nahungu, and then marched on Nakiu, which was occupied on the 25th without opposition.

No. 1 Column moved from Bweho Chini, drove back a strong enemy rearguard at Ndandawala, and on the 26th was closely engaged all day with the enemy in position covering Nahungu. The chief share of the fighting was borne by the 2/2nd K.A.R., supported by the 27th Mountain Battery, which succeeded in knocking out one of the enemy guns in action on Nahungu Hill.

Meanwhile two Nigerian battalions were advancing on Nahungu by a parallel road, and on the 27th they co-operated in the attack, engaging the enemy in position about 1½ miles north-west of Nahungu Hill.

The enemy finally gave way before the combined pressure of these attacks, and evacuated his positions during the night of the 27th/28th.

The cavalry joined the main body at Nahungu on the 30th, having successfully raided many enemy food depôts on the upper part of the river.

The general line of retirement of the enemy was to the south-west; and it was now clear that he had no intention of withdrawing towards Liwale, but that his main force would ultimately centre in the Massassi area. I decided therefore to continue the pursuit from the Mbemkuru River with General Hannyngton's two columns and the cavalry, and to send the Nigerian Brigade south across country to assist the Lindi force by cutting off the enemy's line of retirement. This brigade accordingly left Nahungu on 4th October, and, after a trying march through most difficult country, gained touch with the right of the Lindi force north of Mtama on the 11th. The delay and deviation entailed by the difficult nature of the country caused the brigade to reach its objective (Mahiwa) three days late.

20. The Lindi force had been held back during the first day or two of the Kilwa operations, but I then decided that the time was opportune for a combined movement and directed an attack on Nurunyu and Mtua to begin on the 24th. This was carried out by a wide turning movement south of the Lukuledi River assisted by a frontal attack on the Nurunyu position.

The enemy did not attempt serious resistance at Nurunyu, and, after a short fight with the outflanking column, on the 27th he withdrew during the night towards Mtama, leaving strong rearguards to oppose our advance. The whole country was exceedingly difficult and progress slow. On the 1st October there was sharp fighting halfway between Mtua and Mtama, the enemy counter-attacking heavily, but failing to regain any ground. After this engagement the Lindi force checked the speed of its advance in order to give time for the Nigerian Brigade to come up.

Meanwhile the Kilwa force continued its movement west and south-west, meeting with constant opposition from strong rearguards, which were steadily driven from position to position. The enemy main line of retirement lay through Ruangwa to Ruponda, the destruction of his depôts on the Mbemkuru having prevented him using that route. I directed General Hannyngton to move the bulk of his force by the Mbemkuru route and endeavour to anticipate the enemy at Ruponda, leaving a detachment to press the enemy's rearguard on the direct line of retirement. This detachment I reinforced from my reserve.

General Hannyngton's advanced troops occupied Mnero Mission on the 9th and Ruponda on the 10th, thus completely severing the main enemy communication between Liwale and Massassi, and isolating the enemy forces in the northern Mahenge area. The movement did not, however, greatly affect the enemy retirement from Ruangwa, as it became quickly evident that he had prepared an alternative line east of Ruponda, running south from Ruangwa through Mnacho to the Lindi-Massassi road. The German commander was thus in a position to maintain his central reserve in the vicinity of Namgumburu, and this he continued to do even after the occupation of Ruponda. The situation at this moment demanded careful watching, as a strong enemy movement northwards against our long-drawn-out line of communication to Kilwa was always possible.

The best solution lay in strong pressure by the Lindi force, which made steady progress towards Mtama during the 10th, and on the following days began flanking movements against that place, which was reported to be held by nine companies. The enemy did not, however, stand to fight at Mtama, but retired slowly westwards on the 15th towards Nyangao, being doubtless considerably influenced by the advent of the Nigerian Brigade, which had been ordered to make a wide turning movement north of the Massassi road with the object of getting astride the enemy's communications at Mahiwa.

The German Commander was evidently well aware of the danger of the continued advance of the Lindi force, and decided to use a large portion of his reserve to check it. On the 13th he fell back from Namgumburu towards

Ruangwa, and, leaving a rearguard in that area, marched south-east with about five companies to reinforce his troops at Nyangao. This movement brought on one of the severest fights of the East African Campaign.

21. The Nigerian Brigade had now joined the Lindi force, and was operating on its right flank. One battalion which had been moved to Lindi by sea after the Naumann operations still remained in force reserve. The objective of the brigade was to cut off the enemy's retreat from Nyangao north-westwards and from Mahiwa westwards, and by the night of the 14th it had reached the sanatorium four miles north of Nyangao. Here one battalion (1st Nigerians) was left, together with the brigade reserves of ammunition and supplies; and on the 15th the remainder of the brigade continued its march west. Opposition increased with the advance, and continued all day on the 16th. The enemy succeeded in preventing the 1st Nigerian Battalion (which was called up in support) from joining the remainder of the Brigade in its forward position on the enemy's northern flank, and compelled it to fall back to the Sanatorium with some loss. This made the situation of the Nigerians somewhat precarious, and in order to relieve it Nos. 3 and 4 Columns operating on and parallel to the main road pressed their advance vigorously. The enemy fell back from Nyangao on the 16th, but took up a position on a ridge about two miles south-west of that place, behind the Nakadi River bed, and offered most determined resistance on the 17th. Nos. 3 and 4 Columns were both heavily engaged all day. No. 4 Column (Colonel Tytler) advanced from Nyangao at daybreak, and at once gained touch with the enemy. The 3/4th K.A.R. attacked, supported by artillery fire, and by one o'clock had taken part of the position. No. 3 Column (General O'Grady) had meanwhile come up on the right of No. 4 Column, the Bharatpur Infantry attacking with 1/2nd K.A.R. in support. Opposition to this attack increased steadily, and both battalions were soon fully engaged. At four o'clock a determined counter-attack was made against both columns, and the whole line was pressed back, but again advanced and regained part of the lost ground. Darkness set in with the engagement still proceeding.

On the morning of the 18th the action was resumed, No. 4 Column pressing the enemy vigorously in order to enable No. 3 Column to effect a junction with the Nigerian Brigade, which it succeeded in doing at 8 o'clock. No. 4 Column's attack was at first successful, the 30th Punjabis driving the enemy from their trenches and occupying them, while part of the 3/4th K.A.R. and of the 259th Machine Gun Company came up on the Punjabis' left to strengthen that flank.

The enemy was, however, in force, and delivered a strong counter-attack on the left, which eventually compelled our line to fall back to the river bed. This position was maintained during the afternoon, several counter-attacks being repulsed.

No. 3 Column meanwhile attacked the enemy's left flank and forced it back for some distance, the 3/2nd K.A.R. leading, while the 25th Fusiliers (from No. 4 Column) filled the gap between the attacking fronts of the two columns. On this flank also the enemy developed a very strong counter-attack, gaining some ground, and it was found necessary to restore the situation by bringing up the 3rd Nigerians from reserve to the left of No. 3 Column. The enemy pressure continued until dark, but without further result, and on the morning of the 19th he was found to have retired to his original line.

Losses on both sides were heavy in this four days' engagement, in which much of the fighting had been at close quarters. A halt was advisable until reinforcing drafts could be brought up, and action against the enemy was therefore confined during the next fortnight to vigorous patrolling against his front and round his flanks.

22. Meanwhile to the west the Kilwa force successfully raided Lukuledi Mission. Colonel Orr, with No. 1 Column, leaving Ruponda on the 17th, reached Lukuledi next day, and had a sharp fight with two or three enemy companies. Reconnaissances towards Tshikukwe and Massassi were carried out.

On the 21st the column was attacked at Lukuledi by the force which it had previously fought, reinforced by at least three other companies. The enemy was repulsed with loss, two machine-guns and some prisoners being captured by the 1/3rd K.A.R. The column then withdrew, reaching Ruponda on the 24th. Valuable information about the country, roads, water, etc., had been obtained, which proved of great use to us later on.

No. 2 Column in the centre drove the enemy rearguard from Ruangwa on the 16th and 17th The enemy then withdrew to Mnacho, across a wide waterless strip.

The line from Kilwa had now been stretched so far that maintenance of the forces fed from it was becoming a serious problem, and it had become desirable to call a halt in order to let supplies accumulate forward before making any further advance. I decided accordingly to spend the next fortnight in active patrolling and in refitting and resting the troops before beginning what promised to be the final phase of operations in German East Africa. Until 6th November no further movement of importance took place on the eastern front.

23. Steady pressure on the western front had been maintained during October. General Northey's battalion at Tunduru sent a strong detachment north-east to the Mohesi River, and in the middle of the month strengthened this to two companies and pushed it forward to Abdallah-Kwa-Nanga, the centre of a fertile district some fifty miles south of Liwale. This detachment in turn pushed forward a raiding party of 250 rifles, which entered Liwale on the 29th, capturing twenty-four whites, including sick.

The Songea Column continued its activity on the Luwegu River, and by the 5th had established itself on the north bank east of the enemy position. The enemy gave way and retired some six miles northwards.

I had previously asked General Northey to dispatch the battalion which had joined him from the Iringa Column (2/4th K.A.R.) towards Abdallah Kwa Nanga, but now decided that the situation pointed to the possibility of the Songea and Lupembe Columns being able, in conjunction with the Belgians, to bring the enemy in this area to decisive action. I accordingly requested General Northey to reinforce his Songea Column with this battalion and all available transport. Thus reinforced, Colonel Hawthorn renewed his attack on the 16th October; but the enemy, avoiding the blow, retired down the Luwegu River, destroying and abandoning both his guns. The pursuit was pressed steadily, the enemy retiring from point to point as our troops closed in. By the end of the month he had reached a point on the river south of Liganduka's.

24. The Belgian advance on Mahenge continued steadily over very difficult country, which rendered progress slow; but this was, in any case, unavoidable at the moment, as the long lines of communication made the supply of their forces very difficult. We had hoped that the resources of the country would assist us, but the enemy had practically cleared everything from the line of advance.

On the 4th the Belgian forces were in active contact with eight or nine companies extending from Schauri to just north of Mahenge, and by the 9th had occupied Mahenge, capturing some twenty whites in the last position held, and also ninety-two whites and 242 askaris left sick in hospital. Thus the first and main objective of the Belgians had been most successfully and skilfully attained.

On the 22nd September the Belgian left fought a most successful action against an enemy detachment in position at Mtrika on the Mkaha River, killing or capturing three whites and forty-three askaris, and taking two machine guns.

The Belgian advance continued, and by 18th October their right was in touch with Fair, near Mubike. Saidi was occupied on the 21st, and Ligombazi on the 25th.

Time was, however, getting short in the Mahenge area, where heavy rain might be expected any time after the middle of November. There had been no opportunity to build up a food reserve, and the nature of the road was such that heavy rain might entirely stop the running of mechanical transport.

On the 27th I had a meeting with Colonel Huyghe, and asked him to leave only two battalions in the Mahenge area to co-operate with General Northey's troops, sending the rest back to Kilossa, and to transfer two battalions from his Reserve to the Kilwa line, to operate north and north-west from Liwale. The Kilwa-Liwale line was expected to remain open two months longer than the Kilossa-Mahenge line.

The combined British and Belgian pressure was being severely felt by the enemy, and by the 28th the German Commander in the Mahenge area (Tafel) was reported to be withdrawing all his troops towards Kahambu.

Deserters were numerous, and had begun to surrender to the Belgians in large parties. It was evident that the whole enemy front in the west was giving way, but the great difficulty of supplying our forces at the end of their long lines of communications prevented our taking full immediate advantage of the situation. Both Allies continued, however, to push forward with what troops they could feed.

25. On the night 1st/2nd November Colonel Hawthorn attacked and took the enemy's position south-east of Liganduka's, capturing twenty-four prisoners and a machine gun.

The enemy on the Luwegu retired eastwards, Hawthorn following towards Kabati Mzee, and Fair towards Kabati Mtoto. By the evening of the 5th Hawthorn had driven enemy rearguards down both banks of the Luwegu River, and had got to within a mile of Kabati Mzee; and on the 6th Fair reached Kabati Mtoto, where 142 German whites and 140 askaris surrendered, and three machine guns and some hundreds of rifles, mostly damaged, were found abandoned.

On the 6th eighty-two more askaris surrendered to the Belgian Columns; and, during the next day or two, other surrenders of sick were made at Kahambu and Mlembwe.

It was now clear that the enemy forces were withdrawing to the south through Dapate, and Hawthorn accordingly turned south-eastwards, while Colonel Murray, with 250 rifles, pressed east along the Songea-Liwale road.

The Belgian forces to the north now found that the enemy was beyond their reach, but that, on the other hand, he was coming within the radius of action of the Belgian column of Liwale.

This column, under Major Herion, consisting of the Belgian 9th Battalion and Cyclists, had taken over Liwale from General Northey's detachment (under Major Hawkins) on the 2nd, and was awaiting the arrival of the 4th Battalion, which landed at Kilwa on the 6th. Major Hawkins had withdrawn to Abdallah-Kwa-Nanga, where he awaited the arrival of Lieutenant-Colonel Shorthose with the headquarters and one company of the 1/4th K.A.R. from Tunduru. One company of the battalion was left as garrison at the latter place.

By the 11th it had become practically certain that Tafel's intention was to break south to join Von Lettow Vorbeck, and the final confirmation was received by the locating of his advanced patrols at Mandebe on the 13th. Major Herion despatched 200 rifles south-westwards from Liwale on the 14th, and Colonel Murray with 400 rifles also pushed south-east towards Abdallah-Kwa-Nanga. These reinforcements could not, however, arrive in time to assist Shorthose and Hawkins in stemming the enemy movement to the south, which they most gallantly attempted to do on the 16th when still separated from each other by some hours' march. Each of their small forces put up a determined fight, and inflicted considerable loss on the enemy before being compelled to withdraw towards Tunduru in face of great odds. The Belgian Column succeeded in overtaking the enemy's rearguard company and captured a maxim and some prisoners, including the company commander. Captured documents showed that the enemy's force numbered between 1,700 and 1,800, and was moving southward to the Rovuma in three parallel columns.

This ended all fighting in the Mahenge Liwale area, and in view of the imminent approach of the rainy season in that part of the country it was decided to withdraw all Belgian forces supplied from Dodoma and Kilossa without delay. General Northey took over Mahenge, strengthened Tunduru, and withdrew the bulk of Hawthorn's column to rest and refit.

26. At the beginning of November the enemy's force in the eastern area under direct command of Von Lettow Vorbeck was located as follows:—

Mahiwa front, 7 companies.
Mnacho, 1—2 companies.
Nangoo-Lukuledi, 12—13 companies.
Newala, 2 companies.

The advance of both the Kilwa and Lindi forces was to be renewed on the 6th, and I now suggested to the Portuguese Commander-in-Chief that he should move his force at Unde eastwards and concentrate near Mocimboa Do Ruvuma, with a supporting force at Chomba, and a strong detachment at Ngomano. To this suggestion Colonel Rosa cordially agreed.

On the 6th the Lindi force under General Cunliffe began its advance, the Nigerian Brigade, No. 4 Column and No. 3 Column forming the right, centre and left respectively. The first resistance was encountered by No. 4 Column on the western edge of the clearing near Mahiwa, which was finally taken by the 5th Light Infantry well supported by artillery fire. The main opposition was, however, encountered by No. 3 Column, which established itself on the enemy's right rear, and was heavily engaged throughout the day, the enemy unsuccessfully counter-attacking O'Grady's flanks and rear. The Nigerian Brigade on the north encountered little opposition, and at 15.30 hours was instructed to send two battalions to reinforce No. 3 Column. These, however, had to move through dense bush and did not reach the main road till dusk, by which time firing had ceased.

Next morning the Nigerian Battalions linked up with No. 3 Column and located a strong enemy rearguard entrenched about one mile to the west.

The bulk of the enemy forces had retired towards Nangoo during the night, across a 20-mile waterless tract of country. I directed General Cunliffe to pursue with a force of at least 2,000 men, and the 3/4th K.A.R. was accordingly transferred temporarily from No. 4 Column to No. 3 Column, which was selected for the task.

Two battalions of the Nigerian Brigade moved forward on the 8th to clear the road for the advance of No. 3 Column. These battalions met with constantly increasing opposition; by 15 hours the 3rd Battalion was heavily engaged, and by 16 hours it became necessary to bring up the 4th Battalion and attack the enemy's right. This had the desired effect, and the enemy withdrew as night fell.

The Cape Corps had been brought up in support of the Nigerian attack, and during the afternoon located an enemy machine gun in action on the flank, which they rushed and captured, killing or taking prisoner the whole gun-crew.

No. 3 Column moved at dawn on the 9th and during that day and the 10th was constantly opposed by the enemy rearguard, which fell back from position to position in dense bush. Great difficulty was experienced in providing the column with water. The enemy's last serviceable 4.1 inch Königsberg gun was abandoned en route.

Eventually No. 3 Column reached Nangoo at about 10.30 hours on the 11th, to find that the enemy had retired towards Chiwata. Touch was gained with No. 1 Column of the Kilwa force at Ndanda.

General O'Grady continued the pursuit, gradually driving the enemy back on Chiwata, and by 10.30 hours on the 14th the column was overlooking that place from a commanding position on the edge of the Makonde Plateau.

Meanwhile, the Nigerian Brigade had been brought up and moved west to Ndanda on the 12th, relieving No. 1 Column of the Kilwa force at that place. From Ndanda the Nigerians moved on Chiwata on the 13th.

27. The Kilwa force had moved simultaneously with the Lindi force, No. 2 Column reaching Tandanai and No. 1 Column Tchingwea on the 7th. The 17th Infantry formed a detachment to operate against Mnacho.

On the 8th No. 2 Column reached Lukuledi Mission, and No. 1 Column a point on the Lukuledi River a few miles to the east. Both columns were unopposed, and the movement appeared to surprise the enemy, who continued to hold Mnacho. The Mounted Column (10th South African Horse, 25th Cavalry, and King's African Rifles, Mounted Infantry Company), under Colonel Breytenbach, arrived at Lukuledi on the 9th, and was directed on Mwiti. A detachment from the Mounted Column occupied Massassi on the 10th, taking prisoner fifty-seven German whites and 142 askaris. A damaged 4.1 inch naval gun was found in the post.

On the 10th No. 1 Column occupied Ndanga Mission after some opposition, sixty-four German whites and 129 askaris being captured, including sick. The enemy hastily withdrew his detachment from Mnacho, and the 17th Infantry followed southwards towards Ndanda.

28. With the junction of the Kilwa and Lindi forces the campaign in the southern area entered its last phases. Chiwata had been reported as a strong natural position on the edge of the Makonde Plateau, and the camp was known to contain a large hospital and our prisoners of war.

I decided to attack it from the north with the Lindi force and from the west with the bulk of the Kilwa force, while the mounted troops, supported by infantry, operated towards Kitengari against the enemy line of retirement. These movements were initiated at once by Generals Cunliffe and Hannyngton, and developed during the 13th and 14th, on which days there were continual patrol encounters.

I arrived at Ndanda on the evening of the 14th. No. 1 Column had by then occupied Mwiti after slight resistance, while No. 2 Column was within a mile of Chiwata on the west, with part of the Nigerian Brigade in support. Column 3 had gained the heights to the north-east, as mentioned above.

It became evident early on the 15th that the enemy did not intend to defend Chiwata seriously, but was falling back south-east to Lutshemi. Some opposition was encountered by No. 3 Column on the heights to the east, where the enemy rearguard proved active, but No. 2 Column and the Nigerian Brigade entered Chiwata after only slight opposition, and accepted the surrender of ninety-eight German whites and 425 askaris, including sick; seventy-one European, twenty-eight Indian and twenty-two African prisoners of war were also released. No. 3 Column continued to press forward, and was sharply engaged towards evening with the enemy rearguard.

29. I now directed that No. 1 Column from Mwiti, the Nigerian Brigade from Chiwata, and No. 3 Column from its position on the Plateau should co-operate against Lutshemi, No. 2 Column to form a reserve at Mwiti, while the Mounted Column moved east with the object of cutting communication between

Kitengari and Newala. No. 4 Column was utilised in cutting a motor-road from Mtama towards Luagala.

Fighting was continuous on the 16th round Lutshemi. No. 3 Column and the Nigerians drove the enemy from successive rearguard positions after sharp engagements, while No. 1 Column advanced east from Mwiti. The country was extremely broken and difficult, and progress was slow. The Mounted Column arrived at Lulindi.

The Nigerians, No. 1 Column and No. 3 Column, converged on Lutshemi on the 17th, fighting their way continuously. The enemy began to show signs of unsteadiness, many undamaged rifles being found. The extreme thickness of the bush made it impossible to surround the enemy completely, and during the night of the 17th/18th his main force retired south-east towards Simba's by an unsuspected path. After some rearguard opposition on the 18th, our troops occupied his camp at Lutshemi, releasing 32 European officer prisoners of war, and capturing about 300 German whites and 700 askaris.

No. 2 Column on the 18th captured a patrol sent by Tafel to get communication with Von Lettow Vorbeck.

No. 1 Column was now directed to support the Mounted Troops at Lulindi, while No. 3 Column continued the direct pursuit towards Simba's. No. 2 Column and the Nigerians were held back in reserve in readiness to deal with Tafel's force moving south from the Mahenge area. The exact location of this force was at the moment unknown.

On the 20th patrols reported that the enemy main force had retired south from Simba's-Kitengari area. At Simba's 52 Germans and 75 askaris surrendered to No. 3 Column.

No. 1 Column at once moved against Newala, arriving there on the 21st, but found that the enemy had moved south with great speed and got clear, leaving 126 Germans and 78 askaris in our hands.

30. Reports indicated that Von Lettow Vorbeck was making for the Rovuma and thence intended to go westwards to gain touch with Tafel's force. The latter had been located west of Massassi by our scouts and Intelligence Agents, who reported on the 20th that it was on the upper reaches of, and moving down the Bangalla River. No. 2 Column was accordingly directed to move to Massassi on the 22nd, and thence on the 23rd towards the Bangalla, the Nigerian Brigade to concentrate at Massassi and No. 3 Column at Mwiti. No. 2 Column was placed temporarily under the G.O.C. Lindi force.

The Mounted Column was ordered to move on the 23rd towards the junction of the Bangalla and Rovuma Rivers, and No. 1 Column to concentrate at Luatala on the 23rd in support of the Mounted Column.

Reports on the 23rd showed that the greater part of Tafel's force had passed through Mtimbo on the night 22nd/23rd, and was continuing its march down the Bangalla, and that the bulk of Von Lettow Vorbeck's force was still on the north bank of the Rovuma.

On the 24th No. 2 Column reached the Bangalla, with part of the Nigerian Brigade following in support, while No. 1 Column, pushing on from Luatala in support of the mounted troops, reached the Mwiti River. On the 25th it became clear that the speed with which Von Lettow Vorbeck was moving up the Rovuma made it unlikely that the stern chase after him would succeed; and as a matter of fact he crossed the Rovuma at Ngomano on November 25th and 26th, and escaped up the Lujenda into Portuguese territory. An attempt by the Portuguese garrison at Ngomano to delay this movement was not successful.

31. On the other hand, it now became evident that owing to the speed of our movements Von Lettow Vorbeck had failed to effect his junction with Tafel. The latter was apparently unaware that his Commander had abandoned the Makonde Plateau and Newala, and had therefore decided to leave the Bangalla and move east towards Newala.

On the 25th Tafel's advanced troops engaged our post at Tshirimba Hill. No. 1 Column had reached the Bangalla confluence that morning and seen no sign of the enemy, but on native intelligence being received that the enemy was advancing towards Luatala a cavalry patrol was ordered to return there, backed by the 129th Baluchis.

I directed No. 1 Column to return to Mwiti, No. 3 Column to work south from Nairombo, and No. 2 Column, which had reached Nauru's, to continue its movements towards Wangoni. The Nigerian Brigade was disposed partly at Nauru's, partly on the Bangalla.

On the 26th, the cavalry patrol and 129th Baluchis (about 150 rifles strong) had a sharp engagement near the Mwiti River. The enemy was in much superior strength, forced back this small detachment, and proceeded south. It was evident that Tafel had discovered his mistake, and was trying to break away.

On receipt of the report of this action, No. 1 Column, which was marching to Mwiti River, was directed to move in pursuit and attack the enemy wherever met.

On the 27th a party of 37 Germans, 178 askaris and about 1,100 other natives came in and surrendered to the post at Luatala, and intelligence pointed to the remainder of Tafel's force having moved down the Mwiti River and crossed the Rovuma. No. 1 Column was accordingly ordered to return to Bangalla on the 28th to intercept him, but in the evening a message was received from Tafel stating that he intended a cessation of hostilities. A meeting was arranged, and at midday on the 28th Tafel surrendered unconditionally, with 19 officers (including Schonfeld, Lincke, and Aumann), 92 other Europeans, over 1,200 askaris and some 2,200 other natives.

32. With the surrender of Tafel and the retreat into Portuguese East Africa of Von Lettow Vorbeck with the remnant of his forces (approximately 50 officers, 250 other Europeans, 1,500—1,800 askaris), the campaign in German East Africa came to an end, and the last German colony was conquered after a resistance which had been prolonged until nine-tenths of the enemy's white and black personnel had either been killed or had fallen into our hands. Raiding bands might still re-cross the border, but could scarcely hope again to wage organised war in German East Africa.

An equally arduous campaign, though on a very much smaller scale, will, however, probably still be necessary before the German force in Portuguese East Africa is finally brought to book, for the country is vast and communications are difficult.

33. The last six months of the German East Africa campaign had been of a most exacting nature. My predecessors have well described the difficulties of advancing through tropical Africa against an enemy in possession of interior lines who can advance or retire along carefully prepared lines of supply. As the area of operations diminished so the potential advantages of these interior lines increased and the fiercer became the fighting. The moral of the enemy never wavered, and nothing but the determined gallantry and endurance of the troops finally crushed him. To the infantry, British, South African, Indian, West and East African, I owe unqualified thanks and praise, and especially to the regimental officers, who set an example which all have followed.

During the six months our casualties in action alone have been close on six thousand, including over one thousand carriers and followers, but against these may be placed the 1,618 German whites and 5,482 German Askaris who have been killed or captured in the period. Most of those captured in hospitals were not ill, but were simply tired out by the closeness of our pursuit. Fourteen guns, seventy-seven machine guns and thousands of rifles have also been taken.

Although the nature of the country and of the fighting were such that the infantry had incomparably the hardest task, yet the other fighting arms have done all in their power to lighten it. The artillery and the Stokes Mortar Batteries have afforded steady and close support in action, while the successful raiding of the mounted troops has frequently upset the enemy's plans and movements and so facilitated our advance.

The Royal Flying Corps under Major Wallace, D.S.O., and Royal Naval Air Service, under Commander Bowhill, have been indefatigable in their work of reconnaissance, of such great value in this badly-mapped country, and have never hesitated to take any risks in carrying out this duty. Their well-organised bombing raids have been also most successfully carried out.

The Royal Engineer units, Pioneers, and Road Corps, under the direction of Colonel Rundle, D.S.O., R.E., have done splendid service in keeping pace with the troops, and pushing forward the roads on which the movement of mechanical transport, and consequently of the forces, entirely depend.

The Signal Service has maintained its high reputation in this country and has never failed to cope with any situation which has arisen, often under circumstances of the greatest difficulty. Lieutenant-Colonel Hawtrey, D.S.O., R.E., deserves great credit for the efficient work of this important service.

The good work done by the Intelligence Department, Officers, Scouts, and Agents has very greatly assisted the progress of operations.

Much of this work has necessarily been performed under circumstances of considerable difficulty and danger, but the results have been most valuable, and great credit is due to all ranks.

34. In a campaign of this nature, in which a force comprising a most varied assortment of races and languages has been distributed over many hundreds of miles of wild tropical country where malaria and other serious diseases have been rife, with an entire absence of made roads, and serving under continuously adverse climatic conditions, the strain thrown upon the lines of communication can only be fully realised by those who have participated in it.

During the greater part of the period five separate lines were in use simultaneously, three from the Central Railway, one from Kilwa and one from Lindi. On each of these most careful organisation of posts, depôts and transport had to be made, and maintained and adjusted from time to time in accordance with the fluctuations of the campaign. Transfer from one line to another was an exceedingly difficult matter, in view of the distances which separated them and the constant necessity to economise shipping, yet changes at short notice were inevitable against an enemy acting on interior lines. Only foresight, energy, and incessant labour on the part of the Inspector-General of Communications and his subordinates could solve such problems, and I record here my appreciation of the great services rendered by Brigadier-General W. F. S. Edwards, C.M.G., D.S.O., and those serving under him.

35. From past experience it was recognised that the success of the operations for the period under review must largely depend upon the degree of preparedness and efficiency of the Administrative Services, and active steps were therefore taken for some months beforehand to increase and organise the supply, transport, and medical resources, while tramway construction was expedited to the utmost. Large numbers of box cars, petrol tractors for tramways, and additional personnel were ordered, while the Ordnance and other services similarly anticipated every requirement of the Force. As a result it was in a position to take the field with the knowledge that it could be adequately supported and maintained at considerable distances from its main bases, and this was fully borne out by subsequent results.

In preparation for the Belgian offensive down the Kilossa line, large stocks of supplies were placed at Iringa, while on the Dodoma line animal transport was exploited to the fullest extent. This line is the only one, of the many opened up during the East African campaign, which has proved to be "fly" free. The use of animal transport on it released cars for use elsewhere, while on the Mikesse-Rufiji line the same object was attained by the employment of large numbers of local porters, this course being possible owing to the very thickly populated nature of this area.

Contemporaneously very large numbers of carriers were being assembled in both British and German East Africa, this in view both of the high wastage to be anticipated and the fact that all probable lines of advance lay through fly belts of unusual virulence.

To supplement carriers, a considerable amount of pack donkey transport was also formed and equipped.

It was deemed advisable to depart from generally accepted principles in the matter of the allocation of transport. Instead of units of mechanical transport being attached to field formations and running back to points at which lines of communication convoys could transfer their loads, as has been the practice in the earlier stages of the campaign, Mechanical Transport units of the lines of communication delivered practically into the bivouacs of the troops. This method, while ensuring more effective control of the Mechanical Transport and economising vehicles, entailed in many cases very long hours on the road, with considerable risks in the matter of interruption from enemy action. While several convoys were ambushed and casualties inflicted on convoy personnel, in no case was a convoy unable to beat off the attack.

During August and September the operations against Naumann placed a very severe strain on the Mechanical Transport based on the central railway, but its use, in many cases over tracks never previously pioneered or used by mechanical transport, was largely instrumental in bringing these operations to a successful conclusion.

Sickness has been rife, and the supply and transport personnel has frequently been at breaking point; but with the exception of one or two short periods the troops have always been in receipt of full rations, while the number on a reduced scale at any one time has been very small in proportion to those engaged. That this result has been attained is due almost entirely to the exertions of the Supply and Transport personnel, whose casualties reflect the strain to which they have been subjected, and whose devotion to duty and cheerful acceptance of the hardships of the campaign merit the highest praise. In this connection I would especially bring to notice the name of Brigadier-General P. Hazelton, C.B., C.M.G., Director of Supplies and Transport.

The Medical Services have had many, and at times almost insuperable, difficulties to contend with. Probably in no previous campaign in the tropics have such numbers been employed, and the peculiar conditions, as explained above, have rendered the evacuation of the large number of sick and wounded which had to be dealt with a most difficult problem. Transport of sick has been carried out by porters, motor ambulances, and mechanical transport, plying on the roughest roads, which necessarily at times involved much discomfort to the sick and wounded. Although the internal lines of communication have been long and difficult, the evacuation of sick has been well and expeditiously carried out from the front to the rail and sea bases, and every effort made to minimise the discomfort that might ensue. The mobility of the force has never been impaired by retention of sick at the front. Apart from the large number of wounded dealt with, the sick rate from disease—namely, malaria and dysentery—has been excessive, and entailed large hospital provision to cope with it.

The Sanitary Services have had a most difficult task to keep in check the spread of severe infectious diseases—*e.g.*, cerebro-spinal meningitis and small-pox. These diseases are prevalent in many parts of the country, and liable to be introduced by carriers. Although always present in the force, they had been successfully controlled. The great number of carriers employed necessitated the formation of an elaborate medical organisation to deal with them, involving large hospital establishments. The medical arrangements for carriers has been most carefully considered and well carried out; extensive arrangements for their eventual repatriation have also been made.

An African Native Medical Corps, mainly recruited from Uganda of natives of superior intelligence has been formed, and done excellent work in carrier hospitals and with East African troops.

The climate has been most trying to Europeans and Indian troops, and even the African troops have suffered severely.

The personnel of the Medical Services have suffered equally from climatic effects.

I cannot speak too highly of the enthusiasm and good work done by officers and men of the various Medical Services under the command of Surgeon-General G. D. Hunter, C.B., C.M.G., D.S.O., who have made every effort for the treatment, care and comfort of the sick and wounded, at times under most exceptional and trying conditions.

The ladies of the various Nursing Services have shown the greatest devotion to duty, working at high pressure, regardless of climate and unusual surroundings; they one and all deserve the highest praise.

The Ordnance Services maintained the very high standard of efficiency which has been conspicuous throughout the campaign. The length of time required before orders could be executed from England and elsewhere made the provision of the enormous varieties of stores, equipment and clothing, &c., required by a force comprising so many different types of troops and followers, peculiarly complicated, and it is greatly to the credit of Brigadier-General R. K. Scott, C.M.G., D.S.O., and those serving under him, that every need has been foreseen, and the local resources of the country so fully exploited.

I desire specially to acknowledge the valuable services rendered by Colonel Sir William Johns, Kt., C.B., C.I.E., and all ranks of the railway units and administration. It became evident at an early stage of the operations under review that the only means of maintaining our forces in the field, at a considerable distance from the bases at Kilwa and Lindi, was to establish tramway systems; and the successful manner in which some 115 miles of track was collected and laid, and the requirements of the Army carried forward, without interruption, by petrol-driven tractors and trailers, is worthy of high commendation.

The exceptional conditions prevailing in East Africa have necessitated the employment of carriers to an extent hitherto unprecedented in any military operations. The men have been recruited from British East Africa, German East Africa, N. Rhodesia, and Nyasaland and the West Coast; and a very extensive organisation has had to be evolved to deal with their registration, pay, housing, feeding, medical treatment, and eventual repatriation. The difficulties were accentuated by the different habits of the various tribes, and their great susceptibility to disease, if serving in climates to which they were not accustomed. The conditions under which the men have been employed were necessarily very arduous, and they formed the subject of most careful attention and examination from both within and without the force. The work performed by the carriers has been of the greatest value, and the high state of efficiency attained testifies to the excellent powers of organisation of the Director, Lieutenant-Colonel O. Watkins, D.S.O., and his Staff.

The enormous mortality, due to the many diseases prevalent in Africa, has thrown a very heavy strain on the Remount Department, and the duty of arranging for receiving and forwarding a large number of animals which have been issued during the campaign has been carried out with marked judgment and success.

The work performed by all ranks of the Veterinary Services has been consistently good. In addition to the skilful treatment of the sick animals with the force, much valuable work has been done in combating the many diseases prevalent throughout the country.

The duties of the Political Officers with the force have been of a very varied and responsible nature. They entailed the exploitation of the resources of the country without causing undue hardship or alienating the sympathies of the inhabitants, and the gradual introduction of humane methods of civil administration, as the various districts became clear of active operations.

The present friendly attitude of the people is a tribute to the manner in which these duties have been carried out, and in commending the work of the Officers of the Political Department I would include those serving under His Honour the Administrator, who rendered great assistance to the forces in the field during the operations north of the Central Railway.

The several Pay Departments have carried out their duties to my entire satisfaction, and I desire also to express my appreciation of the services rendered by the Military Audit Staff.

The enormous area over which the troops have been scattered and the unceasing difficulties of transport, have rendered the task of the Postal Services an enormous one, and credit is due to them for the manner in which the requirements of the force have been met.

The spiritual welfare of the troops has been carefully attended to by the Chaplains with the force, and they have also greatly interested themselves in arranging healthy amusements for the men whenever it was possible.

The services of the Provost Establishment have been efficiently carried out, often under very trying conditions.

My thanks are due to Colonel J. L. Montgomery, C.S.I., Commissioner, Royal Red Cross, and his Staff, for their unceasing exertions in providing comforts and augmenting the supplies for the sick. The issues to the hospitals have been on a very generous scale, and the additional gifts of motor launches, boats and vehicles, together with many other useful articles, have been very keenly appreciated.

36. I owe most grateful thanks to Rear-Admiral E. F. B. Charlton, C.B., and all ranks of the Royal Navy, for their hearty and ready co-operation at all times when joint operations were in progress; and to the Naval Transport Service, which has continually to cope with a gigantic and intricate problem, on the successful solution of which the timely conduct of the operations and the smooth working of the supply system so largely depend.

My most sincere thanks are due to Colonel Huyghe, C.B., Commander-in-Chief of the Belgian forces in German East Africa, for his most loyal and efficient co-operation. The Belgian troops are splendid fighters, keen and reliable, and their participation in the campaign has been of the greatest value to the Allied force.

The Governments of India, Union of South Africa, British East Africa, and Uganda have continued to afford me unstintedly the same measure of assistance and support as was enjoyed by my predecessors. Troops, supplies, transport, all have been freely given, to meet the demands which the military situation has from time to time compelled me to make.

Finally I desire to record my warm appreciation of the good work done by my own Staff, by all Services and Departments, and by all Commanders, Staffs, and representatives of Services and Departments in the Field and on Lines of Communication, and in particular I wish to bring to your Lordship's favourable notice the names of the following officers:—

Brigadier-General S. H. Sheppard, C.M.G., D.S.O., who as Chief of my General Staff has afforded me most valuable assistance and unstinted support. He displayed the greatest energy throughout; and this, combined with his unfailing tact, ensured the closest co-operation between all branches of the Staff and all commanders, and greatly facilitated the speedy and successful prosecution of the operations.

Major-General R. H. Ewart, C.B., C.I.E., D.S.O., who, as Deputy-Adjutant and Quartermaster-General, has been responsible for the co-ordinated working of the multifarious administrative branches connected with a campaign of this kind. His duties have also included frequent dealings with Allies and neighbouring Civil authorities, as my representative, on matters of a most diverse and complicated nature. To all he has devoted the greatest energy and ability.

Brigadier-General E. Northey, C.B., A.D.C., who has been in command of the whole of the forces in the Western area, and has carried out a widely extended series of operations with most marked success. The administration and control of his force, and of its bases and long lines of communication, have rested entirely in his hands. I owe much to General Northey for his constant loyal support and co-operation.

Brigadier - General F. G. Cunliffe, C.B., C.M.G., who has rendered valuable services with the Nigerian Brigade, and later in command of the Lindi Force, and has shown marked resource and ability.

Brigadier - General J. A. Hannyngton, C.M.G., D.S.O., who resumed command of the Kilwa force during September after a severe illness and rendered distinguished service during the subsequent operations, under most trying conditions.

Brigadier-General H. de C. O'Grady, who has shown great qualities as a fighting commander and has lost no opportunity of dealing the enemy hard knocks.

Colonel R. T. I. Ridgway, C.B., an able and experienced soldier who commanded a column in a most capable manner.

Colonel G. M. Orr, who commanded a column throughout the operations and showed marked capacity, judgment and good leadership.

Colonel H. C. Tytler, who commanded a column in the advance from Iringa, and later in the operations against Naumann, and in the Lindi area.

Colonel P. H. Dyke and Colonel J. H. Breytenbach, who rendered good services during the Naumann operations. Later, Colonel Breytenbach commanded the Mounted column to my entire satisfaction.

Colonel A. J. Taylor, D.S.O., who did good work in the Kilwa and Lindi areas in command of a column.

Colonel D. J. K. B. Van Deventer, who, though he only took command of a column towards the conclusion of the campaign, was still able to render good services.

Lieutenant-Colonels G. M. P. Hawthorn, D.S.O., W. J. T. Shorthose, R. E. Murray, D.S.O., C. H. Fair, D.S.O., who commanded columns under General Northey with conspicuous ability and success.

Also of Brigadier-General E. H. Llewellyn, who, as Commandant of the King's African Rifles, has done much valuable work in organising and preparing the new K.A.R. battalions for the field.

His Honour the Administrator, Sir Horace Byatt, K.C.M.G., whose firm control of the northern part of German East Africa, and cordial support, have been of the greatest assistance to me.

And of the other Officers, Warrant Officers, non-commissioned officers and men included in the list which I am forwarding shortly in connection with this despatch.

I have the honour to be,
My Lord,
Your Lordship's obedient servant,
J. L. VAN DEVENTER,
Lieutenant-General,
Commanding-in-Chief, East African Force.

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RETIREMENT SYSTEM FOR EMPLOYES

OF THE

PUBLIC SCHOOLS OF PENNSYLVANIA

A BRIEF REVIEW OF THE RECENTLY ENACTED MEASURE

BY

OLIVER P. CORNMAN

SECRETARY OF THE JOINT COMMITTEE ON RETIREMENT FUND LEGISLATION OF THE
STATE TEACHERS' LEAGUE AND THE STATE EDUCATIONAL ASSOCIATION

ENACTMENT BY THE LEGISLATURE

The bill to establish a state-wide retirement system for teachers which was prepared under the direction of the Joint Committee was introduced in the Senate by Senator Tompkins. It was there amended so as to include school employes other than teachers. This was regarded as right in principle and strengthened the support which the measure received. It passed the Senate in this form by a vote of 45 to 5.

The Hon. Wm. T. Ramsey acted as sponsor for the bill in the House and conducted the campaign for it with consummate tact and ability. The bill as originally drafted provided for an approximately equal division of the cost between the teachers and the State. In the Appropriations Committee of the House, the suggestion was made that the cost be divided equally between employes, State and local school districts, on the basis of approximately one-third each. The teachers' representatives, however, stated that as they had originally planned to have the teachers share about one-half the cost they were ready to stand by this. The suggested amendment was accordingly changed so that the State's share as at first proposed was divided between the State and the local school districts.

By further amendment the date of operation of the retirement system was changed from July 1, 1918, to July 1, 1919. This postponement will give the Retirement Board additional time in which to establish the necessary system of records and accounts and to collate the actuarial data upon which the appropriation by the Legislature of 1919 shall be based.

With these amendments the measure passed the House by a vote of 174 to 17, was concurred in by the Senate by a vote of 45 to 1. The bill was duly signed by Governor Brumbaugh who was, of course, specially familiar with the subject and had intimate knowledge of the value of a retirement system through his experience with the local system maintained in Philadelphia while he was Superintendent of Schools of that City.

The State Teachers' League and the State Educational Association, the two great organizations of teachers which comprise in their membership nearly all of the 42,727 teachers of Pennsylvania, endeavored through their Joint Committee, to keep the members of the Legislature fully informed; and the overwhelming majorities were accorded the bill after the members of the Legislature had been given every opportunity to become acquainted with its nature and purpose.

To this end the legislators were furnished with a pamphlet comprising a brief but clear analysis of the contents of the measure, a statement of fact and opinion in its support and a complete actuarial report giving in detail a careful estimate of the cost of the proposed system and the technical data upon which the assurance of its soundness was based.

The legislators were also furnished with literature giving the most recent results of exhaustive studies of this problem and authoritative reports upon the status of retirement systems, both in this country and abroad. In this literature there were endorsements of the system proposed for Pennsylvania.

The bill was also endorsed by the Chamber of Commerce of Philadelphia, Harrisburg and other cities, by representatives of the Carnegie Foundation and of the Bureau of Municipal Research of New York City, and by other competent authorities.

RETIREMENT SYSTEM FOR PUBLIC SCHOOL EMPLOYES

PROVISIONS OF THE LAW

To furnish answers to some of the inquiries that are being made concerning the details of the system, the following brief summary of its essential features is given. The prefatory statement should be made that the measure is state-wide and provides that the official school-year in the school district where the employe is engaged shall be recognized as a full year in computing years of service. The interests of the schools of the rural districts, with a seven or eight months school year, therefore, are safeguarded as carefully as those of larger communities with a ten months year.

I. MEMBERSHIP OF THE RETIREMENT ASSOCIATION

The act establishes a retirement system for teachers and other employes of the public school system of the Commonwealth of Pennsylvania. The system will include:

1. All "present employes" who are not members of existing local retirement systems maintained wholly or in part from appropriations or public moneys and who elect to become members of the State system prior to July 1, 1919.

2. All "present employes" who are members of local systems and who elect through a two-thirds vote of the membership of the local association with the approval of the local school board to merge the local association with the State system.

3. All "new entrants" (i. e., those who enter the service after July 1st, 1919) who do not become members of local retirement associations.

II. HOW THE SYSTEM WILL BE MANAGED

The management of the system is vested in a Retirement Board, which is assisted by the Board of School Directors by whom the employes are paid.

1. The Retirement Board is to be constituted as follows: (a) The State Superintendent of Public Instruction; (b) The State Treasurer; (c) One member appointed by the Governor; (d) Three members of the Retirement Association elected from among their number; (e) A seventh member not an employe of the public school nor an officer or employe of the State, to be elected by the other six.

2. The chief duties of the Retirement Board will be: (a) To keep the system actuarially sound; (b) To invest and manage the reserve and savings funds created by the act; (c) To grant retirement allowances as provided by the act.

3. The chief assistance rendered by the school directors will consist in: (a) Furnishing the Retirement Board with the information and records as required in the act, and (b) Making the deductions from salaries of employes certified by the Retirement Board.

III. HOW THE COST WILL BE MAINTAINED

The funds of the system are to be established upon a reserve basis, the cost being divided between the employes, the State and the school district as follows:

1. **Contributions by the employes.** (a) The employes who become members of the Retirement Association will be required to pay a definite perecntage of their yearly salary. This percentage will be determined by their sex and age at the time they begin to make contributions. The rates will vary from slightly more than three per cent. to nearly seven per cent.

(b) The rates of contribution will be computed by the use of mortality tables, interest tables, and other actuarial data. The initial rate paid by the employe will continue unchanged until retirement unless it should be altered at the times of actuarial revaluation which are provided for in the act.

(c) The rate of annual contribution for each "new entrant" must be such that when 62 years of age is attained the reserve accumulated in the individual savings account will be sufficient to purchase approximately one-half the retirement allowance which is provided for the employe by the terms of the act. The cost of that allowance is determined by the average final salary upon which it is based and upon the length of time the annuity will be drawn as shown by the mortality table.

(d) The rate of contributions of employes who have "prior service" at the time the act goes into effect must be such that their accumulated savings fund will be sufficient to purchase one-half of the superannuation allowance due on account of future service, and the State and school districts will provide the total retiring allowance due to the prior service.

(e) Employes whose rates of contributions are over 5 per cent. have the option of reducing the rate to 5 per cent. and receiving at retirement the proportionately smaller annuities that their savings will purchase.

(f) Employes' contributions are placed in a distinct and separate fund, called the Annuity Savings Fund. Each employe's contributions are placed in his or her individual account and may be withdrawn if the contributor leaves the service without purchasing a retirement allowance.

2. **Contributions by the State and school districts.** (a) The State and the school districts will each pay one-quarter of the cost of the superannuation allowance which is dependent upon service rendered after the bill takes effect, and they will each pay one-half the cost of the superannuation allowance dependent upon service rendered prior to the establishment of the retirement system.

(b) The State and school districts will each pay one-half the cost of that part of the disability allowance which the accumulated deductions of the disabled employe do not provide.

(c) The contributions of the State and of the school districts will be made in the following way: Contributions for employes in service at the establishment of the fund will be provided for by a series of payments amounting annually to about 5.6 per cent. of the pay roll of those who contribute. This will distribute the accumulation of "State Annuity Reserve Fund No. 2" over about thirty years after which time this contribution will be no longer necessary. In addition there will be provided a certain percentage of the salary of each entrant into the service after the retirement system is established. What that percentage shall be will depend upon the age at entrance. Assuming an average age at entrance of 23 years for the entire service, the contributions thus provided would amount annually to about 2.56 per cent. of the salaries of men entrants and 2.80 per cent. of the salaries of women entrants.

(d) The contributions of the school district on behalf of those of its employes who become members of the Retirement Association may be made indirectly; the State being authorized to deduct the amount due the retirement system from the total State appropriation for schools due the local district. The school district, therefore, will not be required to make its contribution from the money raised by local school taxes.

(e) The State will contribute the administrative expenses of the system.

IV. THE CONDITIONS OF RETIREMENT

The benefits accruing to contributors to the system and the age and other conditions of retirement are as follows:

1. **Superannuation benefit.** (a) Age for retirement: A superannuation allowance is granted upon the application of a contributor who has attained age 62. Retirement is compulsory at age 70.

(b) Amount of allowance: The amount of the allowance is equal approximately to 1-80th of the average salary of the ten years immediately preceding retirement, multiplied by the number of school years the contributor has rendered service in the State. Should the employe where the rate exceeds 5 per cent. elect to reduce his or her contributions to 5 per cent. the amount of the allowance provided by the employe is reduced proportionately. The employe may elect also to take a smaller allowance and provide that it be continued to dependents. Provision is made in the act for other options of *equivalent actuarial value.*

2. **Disability benefit.** (a) Conditions of retirement: A disability allowance is granted to contributors who are found by examination at any time after ten years of service to be physically or mentally incapacitated for duty. Employes drawing disability allowances who are under 62 years of age must submit to periodic examinations to determine whether disabilities have been removed. Those who recover are to re-enter the service or to have their allowances reduced.

(b) Amount of disability allowance: The amount of the benefit is one-ninetieth of the average salary of the ten years immediately preceding retirement, multiplied by the number of years of service that the employe has rendered. The minimum allowance is 30 per cent. of final salary except that it must not exceed eight-ninths of the amount which the employe would have received had he or she remained in service to obtain a superannuation allowance.

3. **Refund benefit.** To contributors who leave the service without a retirement allowance, or to the estate or contributors who die in the service, full return of contributions is made with four per cent. compound interest. Contributors may elect, in lieu of the refund benefit, an annuity or deferred annuity of the actuarial equivalent of their accumulated contributions.

SOUNDNESS AND WISDOM OF THE LEGISLATION

A careful review of the law, as given in the above analysis of its provisions, will show that in its enactment the following fundamental requirements of an adequate retirement system have been fully met.

1. **The system will be permanently solvent.** This is made certain by having the rates of contributions determined strictly in accordance with modern principles of insurance. For this purpose competent actuarial service was employed and provision was made in the law for periodical actuarial revaluation of assets and liabilities of the system and any necessary readjustment of rates.

2. **The system is scientifically planned** with a view to securing maximum returns both to the employe and to the State in accordance with what both parties in the common enterprise are willing and able to pay. This is assured by providing in the system natural incentives for the retention of able and experienced employes in the service and the means whereby those who become disabled and superannuated may be eliminated without hardship or injustice, thus securing efficiency in the schools, dignifying the teaching profession, and promoting the cause of public education.

3. **The system is within reasonable cost both to the school employes and to the State.** This is assured by placing the superannuation age at 62, by making a lower rate of annuity allowance for disability retirements ocurring at an earlier age and by eliminating the possibility of retirement merely upon service, a "luxury that neither the employe nor the State is willing or able to afford."

4. **The system is on a contributory basis.** This is assured by the provision that each employe who enters the Association shall pay to the system a certain contribution expressed as a percentage of his or her salary. The rates are determined by the sex and present age of the employe and are computed on an actuarial basis.

The employe's retiring allowance will be equal to what his or her accumulated contributions will purchase plus an equal amount contributed by the State and the local school district. The contributions of employes in service at the time the system is adopted would purchase one-half of their retiring allowance for future service. The contributions by the state and the school districts would furnish the other half of the allowance for future service and in addition would provide the retiring allowance for the prior service. School employes and the State and school district are thus equal partners in the retirement plan except that for those already in the system the State and the school districts assume a somewhat larger obligation.

The retirement allowance at age 62 and after 40 years of service would be approximately half pay. The retirement allowance for disability prior to 62 years of age depends on the years of service and will always be considerably less than the superannuation allowance. Provision is also made for a refund of their accumulated contributions for employes who separate from the service.

5. **The system will be co-operatively and safely managed.** This is assured by the constitution of the Retirement Board—the administrative agency of the system.

The Board members are to serve without pay, but may employ necessary clerical, actuarial and medical service. The State Treasurer is the custodian of the funds and the system is under the supervision of the State Insurance Department. The school employes are also represented on the Board. The educational and financial interests of both the employes and the State are thus well safeguarded.

6. **Local interests are properly conserved.** The bill in nowise conflicts with any local system. On the contrary, provision is made whereby teachers having retirement systems may elect, under carefully specified conditions, to join the State fund in lieu of their own. The bill, therefore, offers a solution of the problem for any of the local retirement systems which are not permanently solvent, and offers, even for those that may be financially sound, an alternative system that may be better designed to meet their needs.

7. **The system is in accordance with modern economic and social principles.** It is unfortunately true that the great majority of the retirement systems that have been established in this country are not upon a sound basis. Legislation of this kind has been enacted without due consideration and generally in complete ignorance of the relation between benefits and costs. The apparently "generous" systems are such only at the expense of solvency. The law enacted by the Legislature of Pennsylvania has the unusual distinction of being absolutely sound in its provisions and of having its cost predetermined by careful actuarial computation.

The brief which was published by the Joint Committee on Retirement Fund Legislation in support of the bill sets forth the actuarial data in detail and gives a balance sheet showing costs to both the school employes and the state. It is believed that the brief shows conclusively that the law is both *wise and safe* and that its enactment has met an urgent public need.

Conclusion. The friends of public education in Pennsylvania may confidently feel that the law will give this State a thoroughly modern system, absolutely sound in its financial features, fully in accordance with economic and social principles, reasonable in cost and certain to be effective in promoting the highest interests of public education in this State. This view of the wisdom of this legislation is held not only by the educational associations through whose efforts the enactment of the law was secured, but also by competent authorities on the subject.

Furthermore it may be stated that the Legislature has not only enacted a practical measure that may properly be regarded as one of the most carefully considered pieces of legislation ever devised in the interests of the public schools of this Commonwealth, but has established a retirement system for school employes that will probably come to be regarded as a model for other states throughout this Country.

JOINT COMMITTEE ON RETIREMENT FUND LEGISLATION

LOUISE D. BAGGS,
Supt. of Schools, Bristol.

J. GEORGE BECHT,
Secy., State Board of Education.

OLIVER P. CORNMAN,
Associate Supt., Philadelphia.

GEORGE A. DICKSON,
Supt. of Schools, New Castle.

LUCY W. GLASS,
Teacher of History, Jeannette.

MARY P. LANG,
President, Pittsburgh Teach. Assn.

ROBERT E. LARAMY,
Supt. of Schools, Easton.

EZRA LEHMAN,
Principal, Shippensburg Normal School.

KATHARINE LONGSHORE,
High School, Hazelton.

MARY McARDLE,
Latimer Junior High School, Pittsburgh.

RAYMOND W. SIES,
University of Pittsburgh.

MARGARET M. SULLIVAN,
Asst. Prin., Ward School, Harrisburg.

J. W. SWEENEY,
Supt. Elk Co. Schools, St. Marys.

HERVEY B. WORK,
Superintendent of Schools, Lancaster.

ELIZABETH S. BAKER, Chairman,
Asst. Prin. Camp Curtin School, Harrisburg.

LUCY W. GLASS,
President State Teachers' League.

CHARLES S. DAVIS,
President State Educational Association.

JEANNETTE (PA.) PUB. CO.

Dup

New York, April 1, 1918

Guaranty Trust Company of New York
140 Broadway, New York

Looking Forward

Problems and Opportunities after the War

ADDRESS

By Francis H. Sisson, Vice-President of the Guaranty Trust Company of New York, before the Cleveland Chamber of Commerce, April 2, 1918.

HORACE GREELEY, I believe, once wisely observed of us, the American people, that "our foresight is not as good as our hindsight by a darn sight." Certainly, of all the costly lessons which this war has taught us, none is more pronounced today than that expressed in that sagacious, if homely, sentiment.

In unmasking her own diabolical designs Germany has opened the eyes of the world. Paradox though it seems, she has taught us to look forward through glancing backward. Neither Germany nor any other equally unscrupulous nation, if such there shall ever be, will be able in the future to carry on its political scheming by means of economic imperialism.

The lightnings of this war have stripped these machinations of all their camouflage and revealed them in naked relief to all the world. We understand now that the immense efforts of Germany to produce, transport and sell in foreign countries were not exclusively economic in their object. We realize at last that Germany has struggled for more than commercial prosperity abroad, that she has assiduously and insidiously sought influence over the resources, the industries, the banks, the transportation facilities, the politics, and the very life of the peoples with whom she traded—all in preparation for the Day, which she thought had arrived on August 4, 1914.

Only a few far-seeing ones, prophets crying in the wilderness, as it were, saw and pointed out the perils upon which most people preferred to close their eyes, or were too near-sighted to visualize. But today we comprehend the extent and the significance of the hold Germany had acquired in Russia, in Italy, in Belgium, in South America, as well as the advantages she had gained in France and England.

Guarding the Future

When this war is finished Germany will not be permitted to continue her nefarious work under the same conditions and with the same objects in view. She has awakened all democracies to the necessity of standing firmly together if they are not to perish from the earth. She has created a world-wide determination to guard against further danger of her kind. And, therefore, it behooves us to look forward, wary of the pitfalls of the past, individually and nationally alert alike to peril and to opportunity.

Sometimes it seems as if we were not getting on quite as fast as we ought, but our problems are many and the world has been moving very rapidly of late. We are going forward. Never before have the intellects of industry been so active. Our scientists, working behind the screen of the military censors, are finding the answers to the most baffling problems. New methods of utilizing materials and by-products are being discovered. Our reserves of labor and capital and materials are being brought to bear upon our purpose to see this thing through. We are meeting swiftly changing situations with that vigor and ready adaptation to circumstances which have characterized our people since the day they set out to subdue this new country and to make a home here, to live in freedom.

In view of our failure to look forward or prepare it is significant that we have responded so quickly. We must remember that we have a huge territory and a population of more than 114,000,000, compounded of many races, diverse in its sympathies, naturally loath to leave its customary pursuits. Yet we have done many things with surprising celerity and effectiveness. We have convinced ourselves that the United States has a tremendous job on hand and that we are going to do it. We have at last set in motion a war machine for its accomplishment. We have revised and readjusted our national life to meet this issue. Much as we may regret vexatious delays, waste and inefficiency, yet we know that the spirit of nationalism is still strong, that our capacity for response to new conditions is unimpaired, and that we have the ability to coöperate under proper leadership when the emergency demands it.

Emergency and Opportunity

Emergency and opportunity are very closely related. The first is often the second in disguise. And it is my belief that the emergency which in the present instance has called forth all our powers of concentration and coöperation is nothing more than an opportunity to utilize all the elements that have entered into the construction of this war machine for the building up of an organization adequate to the circumstances in which we, in common with the rest of the world, shall find ourselves after this war ends. There is at hand not only an opportunity, but also something that comes very near to being a necessity if we are to maintain our position among the nations of the world. We must prepare to meet it with all the adaptability, the foresight and the energy we can command. Win the war we must, and will, but never before was there such need of preparing to attain the victories of peace.

Preparing for Peace

Everywhere throughout the world, men and nations are preparing for peace. Their preparations are going forward not in the belief that peace will come in a month, or a year, or within any other fixed period, but rather in the conviction that no matter how far off peace may be, its known problems are of such magnitude and importance as to require immediate consideration. Even those countries which at the moment are chiefly concerned with war measures are taking stock of the future, and are seeking with all the prevision they can command to glean from its uncertainties some understanding of the principles that must obtain in reclaiming the wreck that this conflict has made of the activities and relationships of mankind.

The extent of that wreck is incalculable. It is only when one turns to the problems of eventual peace that some realization may be had of the destruction of the last three and one-half years. The money cost alone has been estimated at $100,000,000,000. Literally millions of men, women and children have been killed, have died, or have been rendered physically useless. Entire countries have been laid waste. In every warring country equipment for the production and distribution of goods other than war supplies, has been deliberately scrapped or allowed to deteriorate beyond hope of rehabilitation. Trade routes on land and sea have been abandoned and new ones, to meet temporary needs, have been established. The demand for ships has taxed the resources of every country in material and labor.

The New Order

Our preparations for peace must be made in conformity, not with the conditions which existed prior to 1914, but with those changed conditions that have been brought about or will have been brought about by the war. Those changes reach to the vitals of social, economic and political life. We face a new order. Wherever the inquirer turns he sees evidence of war's ravages among the thoughts, activities and relationships of men, wherever they are located, or whatever the manner of life they pursue. The withdrawal of untold numbers of men and women from productive enterprise and their devotion to the destruction of other lives and property has made it necessary for the world's consumers to seek out new sources of supply.

High prices for commodities and services of all kinds have invited producers to increase their efforts along customary lines and to extend their endeavors to new enterprises. New trade routes by land and sea have been set up to meet these changes in the sources of production. Consumers have become accustomed to products varying both as to form and content from those formerly imported. On both sides there has come a better understanding of economic conditions and business methods in foreign countries. Nations and peoples are less of a mystery to one another. The buying and selling fields of the trader have inevitably been enlarged by this growth in intercourse resulting from the war.

What War Has Done

Not only has the war increased the knowledge of nations regarding other nations, but whether belligerent or neutral, every nation has been well started on the way to finding itself. Those that have had valuable mineral deposits, but never the enterprise to produce more from them than they needed for direct consumption, have become large exporters. Others have developed their farms, their mines, their forests, their industries, seeking to get from them commodities to exchange for what they in turn needed and striving always to produce more than they consumed, to sell more than they bought. Wherever the necessities of war have not decreed the imposition of restrictions there has been a speeding up of industry and commerce under the impulse of prices fixed in accordance with the law of demand and supply.

Release Productive Energy

We have had a part in this general release of productive energy, this enterprise of distribution. Enormous sums have been invested in war industries and in those which arose because old sources of supply were cut off. Raw materials and manufactured goods have gone to every market in the world and a favorable balance of trade has increased our gold supply and credit balance enormously. In the year ending June 30, 1914, our imports reached a value of nearly one and a half billion dollars, while our exports were almost two and a half billion—or a total of nearly four billions. In the year ending June 30, 1917, our imports amounted to two billion six hundred millions and our exports to nearly six billion three hundred millions. The balance of exports over imports was nearly three billions six hundred and thirty-five millions. That is to say that up to the end of the last ficsal year the total of our foreign trade showed an increase of over 110 per cent. as compared with the last fiscal year before the war, and an increase of 166.2 in the value of exports.

Our Foreign Trade

An analysis of this foreign trade would show that in recent months our imports from Europe have fallen 50 per cent. as compared with those of corresponding months in 1914, while those from other parts of the world have increased 150 per cent. It would also show a greater percentage of gain in exports to countries outside of Europe. The figures are corroborative of what has been said about new markets and new sources of supply for United States products and imports.

While these data are encouraging, and indicate that we have made excellent progress in building up our foreign trade, it must be remembered that the figures represent values rather than volume. An increase of one dollar in the value of exports or imports under present conditions does not necessarily represent an increase in the volume of goods sold or bought.

A report of the Department of Commerce shows the encouraging fact that there was during 1917 a considerable gain in the position of American shipping. The amount of foreign tonnage cleared for different sections was considerably reduced, but the figures for several years back show that American ships have been gaining steadily as carriers of the world's commerce.

Extraordinary Circumstances

These are facts concerning what we have done in the last few years. It is not necessary to point out that they arise from a most extraordinary condition of affairs. The mere fact that while during the ten years preceding the war our domestic trade increased about a billion and a half a year and our foreign trade about a quarter of a billion a year, the former increased eighteen billions three hundred millions during 1917 and our foreign trade has increased for three years at an annual average of one billion seven hundred million, will convince anyone that circumstances have helped us wonderfully. Certainly there must have been a tremendous increase in the amount of labor and capital at work to accomplish these things, but scarcely anyone would contend that our initiative and enterprise were solely responsible for such a remarkable showing.

Preparations of Rivals

The truth of the matter is that many of our products have been sold without much effort on our part. For a considerable period America has been the only extensive free market, and other nations have come to us to make purchases because their customary commercial relations were interrupted by the war, or because the purchasing nation was devoting all of its time and energy to the war. Other neutral nations and Japan were literally forced into foreign trading. Now that we ourselves are heart and hand in the business of fighting we shall probably experience some diminution in the extension of our foreign business. But that is not to say that we are to lose all we have gained or that we are to slump in spirit and initiative. Our energies are simply turned in another direction for the moment, and our whole situation is incomparably better than is that of our allies with respect to readiness to resume peaceful occupations. As matters stand now, they must go through a rather indefinite period during which they will be rebuilding their devastated homes, equipping their industries, reëstablishing their transportation systems and making arrangements for the absorption of their vast military and naval establishments.

The great danger with respect to our future is that we shall not appreciate the character and extent of the preparations which those who are to be our business and trade rivals are making to regain their lost preëminence in industry, commerce and finance. They are under compulsion to make supreme efforts, for they are deep in debt. To pay their debts will be the ambition of all honorable nations. Today all wise, far-seeing nations are planning to that end.

Training for Trade

Through all their plans runs the purpose to concentrate their efforts upon foreign trade. Only by selling abroad the products of others can they hope to pay their debts. In preparation for this they are drawing into more effective position their financial resources. Banking institutions are combining. Schemes are afoot for establishing trade and merchandise banks to keep in close touch with industrial and commercial enterprises. They are taking stock of their natural resources and studying ways and means of distributing their own raw materials most effectively. Great Britain, France and Germany have determined to get wealth from very possible source both at home and in their dominions and colonies.

Government with Business

The governments of those nation's have clasped hands with business. One is to support the other in every way consistent with the public weal. Not only is business to be set free, but it is to have the assistance of the government in taking advantage of that freedom. By every means they can command these nations are spreading among their people an understanding of the situation they face and implanting the idea that to prevail over it every element of productive effort must be brought into harmony with every other. To regain their prosperity they must coöperate fully and intelligently and foreign trade has become the rallying point for national endeavor.

Aside from a favorable position at the opening of this race for commercial supremacy, America has certain other advantages of importance. At the foundation lies a huge gold reserve upon which can be built a structure of credit sufficient not only to finance our own enterprises, but also to give aid to those of foreign countries. To guide and assist these credit extensions we have a banking system characterized by some of our rivals as ideal. This system will lend itself to the extension of American financial houses into foreign countries. Already a beginning has been made, not only by the setting up of branch banks and foreign offices—establishments which may be termed money and credit depots for the advancing trade army—but also by the organization of merchandise banks, institutions with the usefulness and working of which European nations have long been familiar.

A Nation of Resources

It is because our response to war conditions has shown a ready adaptation to circumstances that we need have no fears as to how this country will avail itself of the quickly expanding opportunities of peace. We are a nation resourceful in ideas, and once we get convincingly before us the fact that we are in for a period of the intensest, most extended, most intelligently directed competition industry and commerce and finance have ever known, it is certain that we shall rise to the occasion and be worthy of the struggle.

But we must not come to the end of this war relying solely upon our ready adaptability. This problem is so big, the future is so crowded with opportunities, that definite plans must be made now. There is a growing appreciation among our people of the situation, but they are looking for leadership. Surely it is the duty of those trained in practical economics, our business men, our industrial managers, our financiers, to undertake these preparations, to show the way. Just as many of our institutions are now setting aside reserves to meet any possible deflation of values in the future, so should every industrial and financial institution set aside from the problems of the moment a portion of its time for the consideration of the conditions we shall have to meet and of how to meet them.

Intelligent Development

There ought to be throughout this country the closest attention to efficiency in all our undertakings. We must study to increase production and to improve our methods of distribution. We should take advantage of every device that will give effectiveness to the labor of men or the use of money and credit. We should apply to every available natural resource of this country the fullest measure of intelligent development. And we must learn to coöperate in these things. Otherwise the American trader who has everything else in his favor will be unable to compete in the markets of the world with his rivals. This great contest for commercial preëminence is to be a contest between nations and no individual may hope to survive it if he has to go alone."

This, in broad outline, is the situation. To the solution of these problems every great nation of the world, with the exception of the United States, is already giving the thought of its most able men. Under the auspices of their respective governments, financiers, manufacturers, traders and workmen are being organized for the purpose of investigating and reporting on what will best serve to lift their various enterprises out of the ruin of war. When all the resultant mass of information and opinion shall have been accumulated and organized it will be coördinated and will form the basis of policies which the governments are expected to adopt.

Facing the Future

Already it is evident that some of these policies may shatter traditions and ideals long adhered to, and will be bitterly opposed both by those who live in the past and those who only dream of the future. Economic fallacies must be laid by. False theories of restriction and regulation exposed. Unfair advantages and discriminations abolished. Certain it is, however, that these problems of peace must be solved and the nation that solves them with the largest measure of vision and practical insight will soonest get out of debt and resume a prosperous career. War is now the supreme effort of the nations. After the war, all will be concentrated no less vigorously on the work of reconstruction.

Government Aid Lacking

In the United States there has been, so far, no organized undertaking on the part of the Government looking to the solution of these problems. The future political and military relations of this country to the rest of the world have been set forth by the President, but neither he nor the Congress has approached the question of financial, industrial and social reconstruction as a whole. Here and there in war measures or in the proposals of department heads may be discerned evidences of individual investigation and thinking, but thus far there has been no coöperative and avowed effort along this line as in other countries. No special body to enter upon this work has been organized here, and while it may be assumed that such Departments as those of the Treasury, the Interior, Agriculture, Commerce and Labor are devoting some of their time to reconstruction measures there is as yet no agency for the coördination of their findings and the suggestion of general policies unless it be Congress itself, a purely political body.

Up to the present time the task has devolved largely upon individuals, corporations and associations who have no official standing. A great deal has been done in a desultory, detached sort of way, but no medium for interchange of opinion except the press, or for coöperative effort, has been created. This country seems not yet to have sensed the fact that the day of individual efforts and purposes, as distinguished from coöperation and public service, has passed; that this war has established not only the interdependence of nations but also the interdependence of individuals and classes within the nation and that common understanding, counsel and coöperation are surely to be the watchwords of the future.

THE FREE PUBLIC LIBRARY OF NEWARK, NEW JERSEY

REPORT FOR 1917

To the Honorable Commissioners:

We hand you herewith the report of the operations of the institution in our charge for the calendar year, 1917.

Respectfully,

THE BOARD OF TRUSTEES.
Hon. Charles P. Gillen,
Mayor of Newark, *ex-officio;*
——————————,
Supt. of Schools, *ex-officio;*
Hon. Thomas L. Raymond,
R. C. Jenkinson,
J. Henry Bacheller,
Lathrop Anderson.

A NOTE BY THE LIBRARIAN

No one can tell just what a free public library does for the city which supports it. One can point to the pleasure it gives to those who use it; but this is a very vague and general product, of the nature indeed of the pleasure given by a public park or a smooth pavement. One can point now and then to a specific case of a person who is definitely helped by the facts and opinions found in the library's books; but cases of this kind are rather rare and are much like those which a good daily newspaper could number by thousands.

Let the question be—"Just how much is added by a public library to a city's enlightenment and civility; to the breadth of its views and to refinement of its daily life; to the reasonableness of its conduct and to the depth and richness of its feelings?" Let this be the question and no answer can be given.

Perhaps it is better so. Perhaps it is wise merely to refer to the fact that in most cases, the best cities have the best libraries and the libraries that are most used and most generously supported, and leave each inquirer to make his choice between two conclusions,—that the good libraries help to make the good cities, or that the good cities insist on having good libraries;—not forgetting that in some cases, poor cities have good libraries thrust upon them.

With this question of what a library does to its city goes quite naturally the question of what a city does with its library. A library can tell and usually does once a year, as we do in the statistical tables which follows, how many books and of what kinds the city took home to read in the preceding twelve months. But we who are on the inside know that while these figures are gratifying to our pride as managers, they are not satisfying to our curiosity, which keeps us continually asking, "Well, what of it?"

This library has the name of being grateful to its owners, the people of Newark; and the people of Newark have the name of not being much in the way of readers. I hope the former report is true, and I realize that all the factors that have gone to make the Newark of to-day would suggest that the latter is also.

But here are a few facts which can make one who is generous-minded and mildly inquisitive quite ready to believe that a public library does add no small sum each year to its city's illumination and reflection, and that in the particular case of Newark the city does far more with its library than most could believe.

From our shelves I took a few books at random, rather I took them because they happened to be, on certain occasions in the past few weeks, of special interest to me. Library markings in the back of each told me how many times each had been taken home by a Newarker,—and I should add that they all looked as though they had been read as well as taken home.

Here are some of the books, and what the marks told me: Vol. 1 of the plays of Sophocles, Greek and English text on opposite pages. This was put on the shelves about January, 1914. Between then and April, 1917, it was taken out twenty times.

Now Sophocles is not a best seller. He was very popular as a playwright in Athens about 2,300 years ago and to-day, in Newark, Mr. Harold Bell Wright is probably more widely approved than he. Yet twenty of our fellow-citizens have, in recent months, avowed an interest in Sophocles. I could give their names and wish I dared to do so. In one of the plays the girl, Antigone, is told that she must die if she does that which love for her dead brother compels her to do,—and she answers, "Then the worst that can befall me is to die an honourable death." Creon, the King, moralizing on the conduct of his people, says, "Of evils current upon earth the worst is money." Words like these from a great tragedy, one of the greatest tragedies, and the whole tragedy itself seem to have still an interest for Newarkers,—though spoken first in a great theatre 450 years before Christ.

I should add that the library has other copies in English of the plays of Sophocles and a look into them all would surely show that more than twenty of our neighbors have returned to the Greek drama in the past few months.

Warner Fite is now a professor in Princeton. While a professor in Indiana University in 1911 he wrote and published a book on "Individualism." This is not a popular topic. The times are making us all look to our legislators for salvation and not to ourselves. Yet this book shows marks of hard reading and has been in the hands of more than twenty borrowers in the six years the library has owned it. Not a remarkable showing, truly, but if you will run your eyes over the several odd thousand books our shelves contain on the subject of human society, you may wonder that twenty selected it when there are so many of far more fetching titles.

One more example will be enough to complete my text. This also goes back to the ancients and is W. W. Fowler's book on "Social Life at Rome in the Age of Cicero." We bought it November, 1912, and it has been in active use thirteen times since then. This book is distinctly "popular" in its field, though not in the sense in which we use that word of the essays of Mr. Bok or Colonel Harvey. It happens to have been written by a man who knows his subject and has learned how to write. It is so true and so clear and so helpful to our understanding of history and of the traits of men that our high school teachers recommend it to their pupils. It has been to three high schools and was probably used by many students at each place. It is agreeably worn. Of books akin to it—that is, of good books on Roman life and history—the library has many, and many use them.

These are near to being library secrets. Surely no one will charge me with wishing to be patronizing toward our city when I thus far disclose them. It is, in fact, minor points like these, familiar enough to us who daily buy and arrange and point inquirers to and lend good books, which keep alive in us the feeling that our labor is not wasted and is not even rightly to be called trivial. Two hundred and fifty-six thousand books are a good many, especially if they are supplemented by thousands of pamphlets, and pictures, and a thousand current journals, and when we make them convenient to the hands of the nearly 400,000 men and women and boys and girls of our city we think the latter use wisely the former and that the former bring pleasure and wisdom to the latter—in fact, we know it.

March 1, 1918.

(Signed) J. C. DANA, *Librarian.*

STATISTICS FOR 1917

BOOKS LENT, ARRANGED BY AGENCIES.

	1913	1914	1915	1916	1917
Main Library, adult	286,863	299,650	350,561	322,436	324,575
Main Library, children ...	56,178	60,137	87,156	81,878	87,418
School Libraries.	107,844	71,796	76,350	96,061	93,174
Branch 1.	100,004	78,823	86,058	82,589	72,868
Branch 2.	12,150	19,749	23,347	18,240	4,042
Branch 3.	109,236	118,849	123,157	114,960	107,216
Branch 4.	143,569	170,651	168,488	132,684	143,215
Branch 5.	55,588	68,393	72,945	56,232	64,269
Branch 6.	78,645	104,184	117,142	109,185	121,640
Branch 7.	......	1,437	26,277	34,993	53,369
Branch 8.	......	......	14,863	31,984	31,721
Branch 9.	......	......	......	4,185	32,673
Branch 10.	......	......	......	313	9,973
Barringer High ...	11,637	11,327	9,068	......	......
Deposit Stations..	95,631	84,365	......	......	......
Post Office.	1,062	199	......	......	......
Firemen's Libraries.	7,200	6,350	......	......	......
Police Libraries.	2,400	1,650	......	......	......
Periodicals.	21,243	16,113	20,327	18,670	19,825
Factory Libraries.	3,161	2,182	......	......	......
City Home	1,164	1,095	......	......	......
House of Detention	2,070	2,010	......	1,793	2,157
Y.W.C.A..	1,138	83	......	......	......
Other Traveling Libraries .	1,615	3,186	......	......	......
School Branches.	......	......	17,976	15,892	......
Sta. V.&N.	......	......	1,102	1,831	1,899
	1,098,398	1,122,229	1,194,817	1,123,926	1,170,034

BOOKS LENT, 1917, MAIN LIBRARY, BY CLASSES.

	Adult	Children	Total	Per Cent.
General Works	1,098	1,181	2,279	0.5
Philosophy	7,283	52	7,335	1.7
Religion	3,849	930	4,779	1.1
Sociology	15,538	14,658	30,196	7.0
Philology	3,927	4,779	8,706	2.0
Natural Science	11,745	2,295	14,040	3.2
Useful Arts	21,975	1,950	23,925	5.6
Fine Arts	15,604	3,915	19,519	4.5
Literature	22,353	3,397	25,750	6.0
History	10,507	4,969	15,476	3.6
Travel and Description..	5,448	2,813	8,261	1.9
Biography	6,335	2,772	9,107	2.1
Fiction	178,511	43,707	222,218	51.5
Duplicate Collection	20.402	.....	20,402	4.7
Periodicals	19,825	.....	19,825	4.6
	344,400	87,418	431,818	100.0

BOOKS LENT, 1889-1917.

The circulation for the past twenty-eight years is as follows:

1889–90	330,810	1904	465,674
1890–91	306,066	1905	511,294
1891–92	272,347	1906	552,615
1892–93	268,320	1907	629,891
1893–94	321,533	1908	851,009
1894–95	332,078	1909	852,785
1895–96	337,738	1910	929,665
1897	364,728	1911	1,054,304
1898	357,504	1912	1,073,054
1899	346,985	1913	1,098,398
1900	331,526	1914	1,122,229
1901	314,874	1915	1,194,817
1902	357,266	1916	1,123,926
1903	428,564	1917	1,170,034
			17,300,034

1916, ACCESSIONS.

Number of volumes in the library as last reported	245,607
Increase by purchase	16,330
Increase by gift	771
Increase by binding pamphlets	707
Increase by binding periodicals	438
Number of missing volumes restored since last report	133
Number of volumes received since last report...	18,379
Number of volumes missing or withdrawn since last report	7,405
Total number of volumes in library	256,581

1917, ACCESSIONS, BY CLASSES.

General Works	353
Philosophy	160
Religion	246
Sociology	1,097
Philology	132
Natural Science	342
Useful Arts	1,404
Fine Arts	587
Literature	749
History	567
Travel and Description	357
Biography	274
Fiction	392
Duplicates	11,586
Total	18,246

1917, MISCELLANEOUS STATISTICS.

	Adult Dept.	Children's Room	
Average daily use (home), main library only	1,078	290	
Largest daily use (main library only)....	3,080	933	
Smallest daily use (main library only)...	340	2	
Volumes lost and paid for	279	185	
Volumes worn out and withdrawn	3,711	3,327	
Number of reserve postals issued	2,433	39	
Registration Department—			
Volumes collected by messenger	931	213	
Names registered during the year	13,416	7,672	
Total live registration	40,457	24,074	
Contagious diseases reported by Board of Health	11,106		
Cards withheld on this account	150		
Pamphlets and clippings lent			4,000
Poems lent			12,355
Books lent to N. J. libraries			674
Requests for special information:			
At Main Library			30,595
At branches			21,369
Art Department:			
Books lent			5,061
Pictures lent			100,906
Lithographs lent			3,238
Number of schools which regularly use pictures			46
Special exhibits sent to other cities			29
Branches:			
New borrowers registered at branches			11,160
Books lent at branches			640,407
Foreign Branch:			
Books lent, total			143,215
German	1,503		
Hebrew	343		
Hungarian	1,088		
Italian	409		
Polish	2,972		
Russian	1,438		
Ruthenian	1,238		
Yiddish	3,885		
Total	12,876		
School Department:			
Books sent to schools in class-room libraries...			11,209
Museum Association:			
Attendance			75,296
Objects lent			4,008

STATISTICS FOR 1917

Report of J. H. Bacheller, Treasurer, for the year 1917.

Date	Item			
Jan. 1	To balance as per 1916 report			$1.32
	To city appropriation 1917, less amount deducted for interest and sinking fund charges on account Library Building bonds		$129,807.03	
	To special appropriation		6,000.00	
	To fines, duplicate collection, etc.		12,948.21	
	To interest on deposits		186.66	
	To Newark Museum Asso:			
	Services	$5,292.09		
	Light, heat, etc.	1,000.00		
	Printing, telephone, etc.	336.22		
			6,628.31	
	To Newark Board of Education, cartage	$796.01		
		404.80		
			1,200.81	
	To L. Bamberger Co., sta. library	$9.00		
		9.00		
		18.00		
			36.00	
	To L. S. Plaut Co., sta. library	$9.00		
		9.00		
		18.00		
	Lost books	14.62		
			50.62	
	To Soldiers' books, stock sold	$51.67		
		54.30		
		15.98		
			121.95	
	To Latin Exhibit payments:			
	Cambridge, Mass.	$10.00		
	Dayton, O.	10.00		
	Bloomsburg, Pa.	10.00		
	Princeton, N. J.	10.00		
	Brooklyn, N. Y.	10.00		
	Fitchburg, Mass.	10.00		
	Akron, O.	10.00		
	Kansas Normal	10.00		
	Dartmouth College	10.00		
	Univ. of Michigan	10.00		
	Germantown, Pa.	10.00		
	Hanford, Cal.	5.00		
	Portland, Ore.	5.00		
			120.00	
	To 56 Business Books:			
	Sioux City, Ia.	$7.50		
	Trenton, N. J.	10.00		
	Rochester, N. Y.	10.00		
	New Bedford, Mass.	10.00		
	Jackson, Mich.	10.00		
	Davenport, Ia.	10.00		
	Detroit, Mich.	10.00		
	St. Louis, Mo.	10.00		
	Des Moines, Ia.	10.00		
	Queensboro, N. Y.	10.00		
			97.50	
	To War Poster Exhibit:			
	Pratt Institute	10.00		
	New Jersey State Mus.	10.00		
	Syracuse Library	10.00		
			30.00	
	To miscellaneous receipts:			
	Check No. 2564 deposited by payee but not returned	4.00		
Jan. 12	To worn lamps sold	7.73		
Mar. 19	To H. W. Wilson Co., advertising	50.00		
May 16	To Newark Contemporary, printing	12.10		
31	To Liability Insurance, Wales	100.00		
	To White Refrigerator Co., refund	1.00		
July 25	To Vacant Lot Committee, printing	2.50		
Aug. 21	To Asso. Adver. Clubs, refund	282.33		
Oct. 8	Worn lamps sold	6.06		
Nov. 1	To salary refund, Schurr	8.48		
5	To Salary refund, Gardner	3.30		
12	To East Orange Library, printing	9.25		
Dec. 13	To Young bequest, interest	20.20		
14	To Nation's Business, articles	50.00		
31	To Amer. Liby. Asso., refund express	62.64		
			619.59	157,846.66
				$157,848.00

Fines, etc., noted above were received by months as follows:

December, 1916	$1,152.57
January, 1917	1,244.86
February, 1917	1,032.34
March, 1917	1,127.46
April, 1917	961.34
May, 1917	989.50
June, 1917	1,005.55
July, 1917	860.91
August, 1917	765.60
September, 1917	811.88
October, 1917	907.34
November, 1917	1,010.85
December, 1917	1,078.01
	$12,948.21

Fines, etc., noted above were received by source and class (13 months) as follows:

Fines	
Main Library	$4,287.19
Business Branch	824.93
Clark Branch	19.85
Roseville Branch	678.79
Springfield Branch	458.23
Ferry Branch	272.85
Clinton Branch	549.15
West Side Branch	99.04
Lafayette Branch	33.29
Cleveland Branch	45.72
Vailsburgh Branch	10.09
	$7,279.13
Duplicate Collection	
Main Library	$1,374.10
Business Branch	1,028.34
Clark Branch	8.47
Roseville Branch	908.19
Springfield Branch	133.90
Ferry Branch	125.94
Clinton Branch	600.75
West Side Branch	1.05
Lafayette Branch	6.37
Cleveland Branch	3.42
Vailsburgh Branch	.76
	$4,191.29

Non-resident and temp. borrowers.	$300.49
New cards	1.00
Reserves	60.54
Lost books	444.08
Damaged books	337.99
Telephones	33.85
100-novel lists	2.25
1000-novel lists	2.00
Y. P. D. lists	5.40
Reading for pleasure	6.92
War Poster pamphlet	2.30
Roseville Branch pamphlet	6.00
Star Spangled Banner pamphlet	.60
1600 Business Books	9.00
Stock sold	138,66
Miscellaneous	126.71
	$1,477.79

By expenditures upon vouchers audited in regular form by a majority of the Board of Trustees and ordered paid by the Board on the following accounts:

Books		$16,622.84	
Art books, pictures, etc		691.72	
Binding		7,942.75	
Periodicals, main library		2,165.00	
Periodicals, branches		995.65	
Postage, general		666.44	
Postage, lending department		290.00	
Postage, branches		170.00	
Trolley fares		282.10	
Temporary resident refunds		126.99	
Catalog department incidentals		391.83	
Express and cartage		415.95	
School deliveries		934.11	
Telephones, main library		481.14	
Janitor's supplies		1,053.13	
Cleaning windows		303.00	
Water and ice		284.25	
Building rep. and alterations		1,245.30	
Furniture, equipment and rep.		3,023.18	
Insurance		1,134.29	
Coal		5,985.90	
Water, boiler		268.04	
Oil, waste, etc.		191.35	
Engineer's sundries		413.24	
Lamps		460.13	
Repairs, engines and dynamos		42.84	
Repairs, elevators and booklifts		106.16	
Gas		417.70	
Printing		860.45	
Printing lists		294.13	
Stationery		1,663.32	
Incidentals from petty cash		677.69	
Miscellany		2,260.79	
Dues and memberships		122.75	
Cash advance to librarian		350.00	
Branch deliveries		1,382.53	
			$53,334.16
Business Branch, rent	$3,900.00		
light, etc.	338.95		
incidentals	429.50		
		4,668.45	
Clark Branch, incidentals		1.75	
Roseville Branch, rent	$1,051.00		
light, etc.	285.88		
incidentals	306.04		
		1,642.92	
Springfield Branch, rent	1,380.00		
light, etc.	319.19		
incidentals	205.45		
		1,904.64	
Ferry Branch, rent	960.00		
light, etc.	201.48		
incidentals	114.86		
		1,276.34	
Clinton Branch, rent	1,200.00		
light, etc.	208.66		
incidentals	133.64		
		1,542.30	
West Side Branch, incidentals		39.70	
Lafayette Branch, incidentals		2.75	
Cleveland Branch, incidentals		3.00	
Vailsburgh Branch, incidentals		8.53	
			$12,472.91
Salaries—			
Librarian's office	$8,199.90		
Asst. librarian's office	4,320.10		
General office	5,594.95		
Catalog dept.	4,774.57		
Technical dept.	4.423.11		
Lending dept.	10,184.23		
Fiction dept.	2,613.32		
Registration dept.	2,548.99		
Art dept.	3,420.08		
Museum dept.	5,033.79		
Children's dept.	2,143.32		
School dept.	2,201.77		
Bindery and repair	2,109.90		
Telephone dept.	768.47		
Sundays and holidays	344.18		
		58,680.68	
Branches	2,461.08		
Business Branch	3,567.09		
Clark Branch	107.00		
Roseville Branch	1,981.13		
Springfield Branch	3,364.39		
Ferry Branch	1,537.97		
Clinton Branch	1,857.91		
West Side Branch	789.16		
Lafayette Branch	531.35		
Cleveland Branch	476.19		
Vailsburgh Branch	148.50		
		16,821.77	
Janitors' department		8,864.46	
Engineers' department		6,433.01	
Elevator		1,080.59	
			91,880.51
Balance December 31, 1917			160.42
			$157,848.00

YOUNG BEQUEST ACCOUNT.

Jan. 1, 1917—		
To balance in Howard Savings	$500.00	
Dec. 1, 1917—		
To interest	20.20	
Dec. 13, 1917—		
By int. drawn and transferred		20.20
Dec. 31, 1917—		
By balance		500.00
	$520.20	$520.20

INCIDENTAL CASH IN LIBRARIAN'S HANDS.

Feb. 28. Special advance	$350.00
Cash advanced to various departments and branches on previous incidental bills, for desk change	68.00
Total cash	$418.00

The American Red Cross
The Red Cross Institute for Crippled and Disabled Men
311 Fourth Avenue New York City

Text of a Proposed Amendment to the Vocational Rehabilitation Bill

THERE has been suggested by several organizations which were concerned in the original draft of a measure to provide vocational rehabilitation for disabled soldiers and sailors, an amendment which would include within the benefits of the bill now under consideration in Congress men crippled or disabled in industry.

The text of the proposed amendment is as follows:

Section 8. That in order to provide for the promotion of the vocational rehabilitation of persons disabled in industry, or otherwise, and their return to civil employment there is hereby appropriated for the use of the States, subject to the provisions of this section, for the purpose of cooperating with them in paying the salaries of teachers, supervisors, and directors for the vocational rehabilitation of such disabled persons, and in training teachers, supervisors, and directors for such vocational rehabilitation for the fiscal year ending June 30, 1919, the sum of $500,000; for the fiscal year ending June 30, 1920, the sum of $750,000; for the fiscal year ending June 30, 1921, and annually thereafter, the sum of $1,000,000. Said sums shall be allotted to the States in the proportion which their urban population bears to the total urban population in the United States, not including outlying possessions, according to the last preceding United States Census; Provided, that the allotment of funds to any State shall not be less than a minimum of $5,000 for any fiscal year, and there is hereby appropriated the following sums, or so much thereof as may be needed, which shall be used for the purpose of providing the minimum allotment to the States provided for in this Section, for the fiscal year ending June 30, 1919, the sum of $66,000; for the fiscal year ending June 30, 1920, the sum of $46,000, for the fiscal year ending June 30, 1921, and annually thereafter, the sum of $34,000.

Section 9. That in order to secure the benefits of the appropriations provided by this Section, any State shall, through the legislative authority thereof, (1) accept the provisions of this Section; (2) designate or create a State board having all necessary power to cooperate as herein provided with the Federal Board for Vocational Education in the administration of the provisions of this Section; (3) appoint as custodian for said appropriations its State Treasurer, who shall receive and provide for the proper custody and disbursement of all money paid to the State from said appropriations.

All moneys expended upon the provisions of this Section shall be upon the condition (1) that for each dollar of Federal money expended the State shall expend an equal amount for the same purpose; (2) that the State Board shall annually submit to the Federal Board for approval plans showing the manner in which it is proposed that the appropriation shall be used, and shall make an annual report to the Federal Board on or before September 1 of each year on the work done in the State and on the receipts and expenditures of money under the provisions of this Section; (3) that no portion of any moneys appropriated by this Section for the benefit of the States shall be applied, directly or indirectly, to the purchase, preservation, erection, or repair of any building or buildings or equipment, or for the purchase or rental of lands, or for the support of any religious or privately owned or conducted school or college; (4) that all courses for vocational rehabilitation and all training of teachers, directors, and supervisors shall be given in schools or classes under public supervision or control, and that all courses for vocational rehabilitation maintained shall be available without cost for instruction, under such rules and regulations as the Federal Board shall prescribe, to any civil employee of the United States disabled while in the performance of his duty.

Section 10. The Federal Board for Vocational Education shall have power to cooperate with State boards in carrying out the purposes and provisions of this Section, and is hereby authorized to make and establish such rules and regulations as may be necessary or appropriate to carry into effect the provisions of this Section and to provide for the vocational rehabilitation of disabled persons and their return to civil employment. It shall be the duty of the said board (1) to examine plans submitted by State boards and approve the same if found to be in conformity with the provisions and purposes of this Section; (2) to ascertain annually whether the several States are using, or are prepared to use, the money received by them in accordance with the provisions of this Section; (3) to certify on or before the first day of January of each year to the Secretary of the Treasury each State which has accepted the provisions of this Section and complied therewith, certifying the amount which each State is entitled to receive under the provisions of this Section; (4) to deduct from the next succeeding annual allotment to any State, whenever any portion of the fund annually allotted has not been expended for the purpose provided for in this Section, a sum equal to such unexpended portion; (5) to withhold the allotment of moneys to any State whenever it shall be determined that moneys allotted are not being expended for the purposes and under the conditions of this Section; (6) to require the replacement, by withholding subsequent allotments, of any portion of the moneys received by the custodian of any State under this Section that by any action or contingency is diminished or lost; Provided, that if any allotment is withheld from any State, the State Board of such State may appeal to the Congress of the United States, and if the Congress shall not direct such sum to be paid it shall be covered into the Treasury.

Section 11. The Secretary of the Treasury, upon the certification of the Federal Board as provided in this Section, shall pay quarterly to the custodian of each State appointed as herein provided the moneys to which it is entitled under the provisions of this Section. The money so received by the custodian for any State shall be paid out on the requisition of the State Board as reimbursement for expenditures already incurred in such schools and classes as are approved by said State Board and are entitled to receive moneys under the provisions of this Section. The Federal Board for Vocational Education shall make an annual report to the Congress on or before December 1 on the administration of this Section, and shall include in such report the reports made by the State boards on the administration of this Section by each State and the expenditure of the money allotted to each State.

Section 12. To be "Section 8" of the Bill as introduced.

The American Red Cross
The Red Cross Institute for Crippled and Disabled Men
311 Fourth Avenue New York City

Introduction in Congress of Measure Providing for the Vocational Rehabilitation of War Cripples

THERE was introduced in the United States Senate on April 8, 1918, by Senator Hoke Smith of Georgia, a measure providing for the vocational rehabilitation of disabled soldiers and sailors. The bill was referred to the Committee on Education and Labor. The move will be welcomed by those who have been anxious to see set under way provision for the re-education of war cripples.

The bill includes in its scope only men disabled in military or naval service—not industrial cripples, as was contemplated in an earlier draft of a measure of similar purpose. Responsibility for the provision of vocational rehabilitation is delegated to the Federal Board for Vocational Education.

The text of the bill (S. 4284, 65th Congress, 2d Session) reads as follows:

A Bill to provide for vocational rehabilitation and return to civil employment of disabled persons discharged from the military or naval forces of the United States, and for other purposes.

BE IT ENACTED BY THE SENATE AND HOUSE OF REPRESENTATIVES OF THE UNITED STATES OF AMERICA IN CONGRESS ASSEMBLED, That this Act shall be known as the vocational rehabilitation Act.

Section 2. That every person who is disabled under circumstances entitling him, after discharge from the military or naval forces of the United States, to compensation under Article III of the Act entitled 'An Act to authorize the establishment of a Bureau of War Risk Insurance in the Treasury Department', approved September second, nineteen hundred and fourteen, as amended, and who, in the opinion of the Federal Board for Vocational Education, is unable to resume the former occupation or to enter upon some other suitable or gainful occupation or having resumed or entered upon such occupation is unable to continue the same successfully and may be vocationally rehabilitated, shall be ordered by the Bureau of War Risk Insurance to follow such course of vocational rehabilitation as the Federal Board for Vocational Education shall prescribe and provide, or when deemed advisable by said board shall be retained in the military or naval forces of the United States and be detailed to the control and direction of said board until the course of training prescribed has been satisfactorily completed.

The Bureau of War Risk Insurance shall have power, and it shall be its duty, to order the persons included in this section to follow suitable courses of vocational rehabilitation to be prescribed and provided by the Federal Board for Vocational Education, and every person so ordered to follow a course of vocational rehabilitation shall, while following the same, receive monthly compensation in a sum equal to the amount of his monthly pay for the last month of his active service, or to the amount to which he would be entitled under Article III of the said Act approved September second, nineteen hundred and fourteen, as amended, whichever amount is the greater, and if such person was an enlisted man at the time of his discharge he shall, for the period during which he is so ordered to follow a course of vocational rehabilitation, be subject to all the requirements and entitled to all the benefits of Article II of the said Act approved September second, nineteen hundred and fourteen, as amended, in the same manner as if he were an enlisted man, and for the purposes of the said Article II his monthly compensation shall be deemed to be his monthly pay: *Provided*, That if and while a person willfully fails to follow the prescribed course of vocational rehabilitation in a manner satisfactory to the Federal Board for Vocational Education the said board shall certify to that effect to the Bureau of War Risk Insurance and the said bureau may, in its discretion, withhold any part or all of the monthly compensation due such person and not subject to compulsory allotment.

The military and naval family allowance appropriation provided for in section eighteen of the said Act approved September second, nineteen hundred and fourteen, as amended, shall be available for the payment of the family allowances provided by this section; and the military and naval compensation appropriation provided for in section nineteen of the said Act approved September second, nineteen hundred and fourteen, as amended, shall be available for the payment of the monthly compensation herein provided. No compensation under Article III of the said Act approved September second, nineteen hundred and fourteen, as amended, shall be paid for the period during which any such person is ordered by the Bureau of War Risk Insurance to follow a course of vocational rehabilitation.

Section 3. That the courses of vocational rehabilitation provided under the provisions of this Act shall, as far as practicable and under such conditions as the Federal Board for Vocational Education may prescribe, be made available without cost for instruction for the benefit of any person who is disabled under circumstances entitling him, after discharge from the military or naval forces of the United States, to compensation under Article III of the said Act approved September second, nineteen hundred and fourteen, as amended, and who is not included in section two hereof: *Provided*, That no monthly compensation, family allowances, or expenses as provided by this Act shall be paid on account of any such person availing himself of the courses under this section.

Section 4. That the Federal Board for Vocational Education shall have the power, and it shall be its duty, to provide, or procure to be provided, such facilities, instructors, and courses of vocational rehabilitation as may be necessary to insure proper training for such persons as are required to follow courses of vocational rehabilitation as herein provided; to prescribe the courses to be followed by such persons; to pay, when in the discretion of the board such payment is necessary, the expense of travel, lodging, subsistence, and other necessary expenses of such persons while following the prescribed courses; to provide for the placement of rehabilitated persons in suitable or gainful occupations; and to do all other things appropriate or necessary to insure the vocational rehabilitation and placement in suitable or gainful occupations of persons following the courses of vocational rehabilitation. The board shall have the power to make such rules and regulations as may be necessary for the proper performance of its duties as prescribed by this Act and is hereby authorized and directed to utilize, with the approval of the Secretary of Labor, the facilities of the Department of Labor, in so far as may be practicable, in the placement of rehabilitated persons in suitable or gainful occupations.

It shall also be the duty of the board to make or cause to have made studies, investigations, and reports regarding the vocational rehabilitation of disabled persons and their placement in suitable or gainful occupations. When the board deems it advisable, such studies, investigations, and reports may be made in cooperation with or through other departments and bureaus of the Government, and the board in its discretion may cooperate with such public or private agencies as it may deem advisable in performing the duties imposed upon it by this Act. The Federal Board for Vocational Education shall make an annual report to the Congress on or before December first on the administration of this Act.

Section 5. That all medical and surgical work or other treatment necessary to give functional and mental restoration to disabled persons prior to their discharge from the military or naval forces of the United States shall be under the control of the War Department and the Navy Department, respectively. Whenever prevocational training is employed as a therapeutic measure by the War Department or the Navy Department a plan shall be established between these agencies and the Federal Board for Vocational Education acting in an advisory capacity to insure, in so far as medical requirements permit, a proper process of prevocational training and the proper preparation of instructors for such prevocational training.

The board shall, in establishing its plans and rules and regulations for vocational training, cooperate with the War Department and the Navy Department in so far as may be necessary to effect a continuous process of prevocational and vocational training.

Section 6. That the Federal Board for Vocational Education is hereby authorized and empowered to receive such gifts and donations from either public or private sources as may be offered unconditionally. All moneys received as gifts or donations shall be paid into the Treasury of the United States and shall constitute a permanent appropriation to be called the 'Special fund for vocational rehabilitation', to be used under the direction of the said board, in connection with the appropriations hereby made or hereafter to be made, to defray the expenses of providing and maintaining courses of vocational rehabilitation; and a full report of all gifts and donations offered and accepted and all disbursements therefrom shall be submitted annually to Congress.

Section 7. That there is hereby appropriated, out of any money in the Treasury of the United States not otherwise appropriated, to be used by the Federal Board for Vocational Education for erecting, renting, and remodeling buildings and quarters, repairing, maintaining, and equipping same, and for equipment and other facilities necessary for proper instruction of disabled persons, $250,000; for the preparation of instructors and salaries of instructors, supervisors, and other experts, including necessary traveling expenses, $545,000; for traveling expenses of disabled persons in connection with training and for lodging, subsistence, and other necessary expenses in special cases of persons following prescribed courses, $250,000; for tuition for persons pursuing courses in existing institutions, public or private, $545,000; for the placement and supervision after placement of vocationally rehabilitated persons $45,000; for studies, investigations, reports, and preparation of special courses of instruction, $55,000; for miscellaneous contingencies, including special mechanical appliances necessary in special cases for disabled men, $110,000; for the administrative expenses of said board incident to performing the duties imposed by this Act including salaries of such assistants, experts, clerks, and other employees in the District of Columbia or elsewhere, as the board may deem necessary, actual traveling and other necessary expenses incurred by the members of the board and by its employees under its orders, including attendance at meetings of educational associations and other organizations, rent and equipment of offices in the District of Columbia and elsewhere, purchase of books of reference, law books, and periodicals, stationery, typewriters and exchange thereof, miscellaneous supplies, postage on foreign mail, printing and binding to be done at the Government Printing Office, and all other necessary expenses, $200,000: *Provided*, That the said board shall file with the Clerk of the House and the Secretary of the Senate on July first and every three months thereafter, for the information of the Congress, an itemized account of all expenditures made under this Act.

Section 8. That section three hundred and four of the Act entitled 'An Act to authorize the establishment of a Bureau of War Risk Insurance in the Treasury Department', approved September second, nineteen hundred and fourteen, as amended, is hereby repealed.

New York, April 1, 1918

Guaranty Trust Company of New York
140 Broadway, New York

Organizing for the Victories of Peace

The Guaranty Trust Company of New York gives herewith an outline of Great Britain's plans to meet conditions after the war. This is the second of a series of papers upon the subject of financial and economic affairs in foreign countries, with particular reference to plans for extending their foreign trade.

THE ASTONISHING growth of America's foreign trade has been an outstanding feature of the last three and a half years. To retain and enlarge the position we now hold in the commercial and financial world is one of our biggest problems. Other countries believe that their future depends upon their success in foreign trade, and are making their preparations accordingly. Every effort we now put forth here to meet the competition that is inevitable is a step toward organizing for the victories of peace.

Great Britain has approached her problem of reconstruction after the war with an enthusiasm and a thoroughness in which there is both suggestion and inspiration for the United States. In spite of the difficulties involved in her world-wide possessions and their diverse peoples, she is resolutely attempting to work out a detailed program for the restoration of her commercial and financial position. No secret is made of the fact that she expects a period of intense competition for the markets and the carrying trade of the world to follow the war, nor of her intention to be as fully prepared for it as possible.

Period of Transition

Her plans naturally divide themselves so as to be in accord with the varying circumstances which will prevail during the period of adjustment to a peace basis, and with the period following the completion of this readjustment. These two periods are hardly separable, so far as general schemes of reconstruction are concerned, and in studying the plans developed by the Ministry of Reconstruction it will be found that they overlap. As a matter of fact, it is the object of the Ministry of Reconstruction, and of all other agencies now engaged upon these problems, to arrange matters so that the period of transition shall be as brief as possible.

Redirecting a Nation's Energy

To that end it is proposed to make plans now for giving permanent direction to all the energy, now temporarily devoted to war work, that will be released for other pursuits when peace is proclaimed. These plans are of tremendous import to the people of Great Britain, and directly to the people of other nations. The idea back of them is that, if the British Empire is to endure, there must be such a refitting of men and industries to meet changed circumstances, and such a redirection of effort, as will insure the utmost development of every resource.

Getting Out of Debt

Upon the surplus of these resources in goods and services which she can dispose of to other countries depends Great Britain's ability to get out of debt and to resume her commercial and financial leadership. Throughout the length and breadth of the empire the idea is being fostered that the future rests upon increasing production and reducing consumption, upon having more and requiring less. As Lord Milner said recently in an address before the London Chamber of Commerce:

"The greatest of all ways for an empire in debt to think is of production; to plan production, to borrow to be able to produce more; to lend to assist more production; to refuse all goods dumped at less than the cost of production—to insist on production from sources where the producers of our needs buy the products of our industries. Increase production, develop prairie, ocean, forest and mine within your magnificent estate and out of the volume of that wealth repay your borrowed money, finding that, after you have so paid, your riches will increase."

INVENTORY OF THE BRITISH EMPIRE

In preparation for this intensive development of her resources, Great Britain is taking what is probably the most remarkable inventory ever attempted. Under the general direction of the Ministry of Reconstruction, the Ministry of Munitions, Department of the Foreign Office and Board of Trade, and other governmental agencies, nearly a hundred committees are busy collecting information regarding agricultural, mining, industrial and commercial conditions within the empire.

The inquiries of these committees touch the life of the British people in all its phases. Wherever the British flag waves these committees are saying to men, women and children: What can you do? What can you make your mines, your farms, your orchards, your plains, your forests, your seas and rivers and lakes do? Have they ever produced wealth? Can they be made to do so? Upon the answers will be founded the principles to which the British people will be asked to adhere in rebuilding the means of prosperity that war has destroyed or disorganized. In addition to these inquiries by committees sanctioned by the Government, other investigations are being made upon the initiative of individual manufacturers or merchants.

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Some idea of the extent of this investigation may be gained from the designations of a few of these committees. The Prime Minister's Committee on Commercial and Industrial Policy is to consider what industries are essential to the future safety of the nation, and what steps should be taken to maintain and establish them; what should be done to recover home and foreign trade lost during the war, and to secure new markets; to what extent and by what means the resources of the empire should and can be developed; to what extent and by what means the sources of supply within the empire can be prevented from falling under foreign control.

THE SELF-GOVERNING DOMINIONS

The Dominions Royal Commission is to inquire into and to report upon the natural resources of the five self-governing Dominions, and the best means of developing their resources; the trade of these parts of the empire with the United Kingdom, each other, and the rest of the world; their requirements and those of the United Kingdom in the matter of food and raw materials, together with the available sources of supply; and to make recommendations and suggest methods consistent with existing fiscal policy, by which the trade of each of the self-governing Dominions with the others and with the United Kingdom can be improved and extended.

FINANCING OVERSEAS TRADE

The Financial Facilities Committee is charged to ascertain whether the normal arrangements to provide financial facilities for trade by means of existing banking and other financial institutions will be adequate to meet the needs of British industry during the period immediately following the termination of the war, and, if not, by what emergency arrangements they should be supplemented. Particular regard is to be paid to the special assistance which may be necessary to facilitate the conversion of shops and factories now engaged upon war work to normal production and their expansion to meet the exceptional demands for raw materials arising from the depletion of stocks.

REQUIREMENTS OF RECONSTRUCTION

The Ministry of Reconstruction has a Central Committee on Materials Supply which is considering the nature and amount of the supplies of materials and foodstuffs which will be required by the United Kingdom, India, the Dominions and the Crown Colonies during the period of readjustment; the probable requirements of belligerents and neutrals for such supplies at the close of hostilities; the sources from which, and the conditions under which such supplies can be obtained and transported and in particular the extent to which they might be obtained from the United Kingdom or within the Empire or from allied or neutral countries.

COTTON

Of special interest to Americans is the appointment of an Indian Cotton Committee to consider the work that has already been done toward the establishment of long-staple cotton; to determine the measure of success achieved, or whether any failure is due to agricultural or economic causes or to administrative difficulties; to make a detailed study of local conditions in each cotton-growing tract, and to inquire into the methods of ginning and marketing; to consider the possibility of developing long-staple cottons in India, and to submit recommendations as to the amount of money and the organization that will be required for that purpose.

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A suggestion of the effort that will be made to develop new industries is contained in the direction to the Engineering Trades Committee to compile a list of the articles suitable for manufacture by those with engineering trade experience, which were either not made in the United Kingdom before the war, but were imported, or were made in small or insufficient quantities, and for which there is likely to be a considerable demand after the war. These are to be classified as to whether they are capable of being made by women, by men, by women alone, or only by skilled men. This committee will also list the industries to which such new manufacturers could most suitably be attached; and will make recommendations on the establishment and development of such industries by the transfer of labor, machines, and otherwise, with due regard to securing the coöperation of labor.

MINERAL RESOURCES

The Imperial Mineral Resources Bureau Committee is to prepare a scheme for the establishment in London of an Imperial Mineral Resources Bureau which is to collect information in regard to the mineral resources and metal requirements of the empire and to advise what action, if any, may appear desirable to enable such resources to be developed and made available to meet requirements.

PRODUCTION AND DISTRIBUTION

In addition to these and many other committees having general powers of investigation the Department of Scientific and Industrial Research has more than a score of committees devoted to the investigation of specific matters such as metallurgy, glass and optical instruments, illumination, abrasives, vitreous compounds, tin, tungsten, lubricants, zinc and copper. The very mention of the names will suggest that searching for raw materials, their exploitation and the possible substitutes for them will enter deeply into the future plans of the empire. Great Britain is investigating many other things that are more social and political than economic, all bearing, however, upon the purpose of bringing her people and their possessions to the greatest efficiency in the production and distribution of goods and services.

INTERNATIONAL COMPETITION

Early in 1916 the President of the Board of Trade, which, it should be remembered, is an integral part of the British governmental system, appointed several Departmental Committees to consider the probable position of various important branches of British industry after the war, "especially in relation to international competition, and to report what measures, if any, are necessary in order to safeguard that position." These committees were the Coal Trades, Iron and Steel Trades, Engineering Trades, Electrical Trades, Non-Ferrous Metal Trades, Shipping and Shipbuilding Industries and Textile Trades.

RAW MATERIALS AND TEXTILES

The reports of these committees have already been submitted and they constitute a formidable array of accurate and detailed information as to the situation confronting these several classes of industries. Just a part of the report made on raw materials for the textile trades will indicate the nature and purpose of the inquiry made. Recognizing the present superiority of the United States as a producer of cotton the committee reported that new fields must be developed to guard against the possibility of a shortage here. India, Egypt, Soudan, the West Indies and the African colonies were discussed as to the extent of land, the character of the cotton and as to labor and transportation conditions. Of India it was reported, for example, that the yield is only from eighty to one hundred pounds of lint per acre as compared with the average yield of 200 pounds an acre in the United States and 450 pounds an acre in Egypt. But otherwise India with agricultural soil, plenty of cheap labor and good railroads is favorably regarded as a place where British ingenuity and persistence may accomplish much. Other possibilities were discussed, with this significant conclusion: "If proper steps are taken it is reasonably certain that all the cotton required by the British Empire can, in time, be grown within its own territories."

AN IMPERIAL SELLING AGENCY

With these arrangements for increasing the volume and improving the quality of the things that can be produced in the British Empire have gone plans for building up a great selling agency. The Government has created a new joint Department of the Foreign Office and the Board of Trade which is known as the Department of Overseas Trade (Development and Intelligence). This body controls the Board of Trade's Trade Commissioner Service within the empire and the Foreign Office's Commercial Attaché Service in foreign countries. In other words a single body is to control and coördinate the sources of information in regard to those who have something to sell and those who are ready to buy. The Trade Commissioner Service is to be strengthened and enlarged and likewise the Consular service. Better trained men are to be sent out to every corner of the world to keep a watchful eye for every chance to sell British goods. The Department of Overseas Trade is to undertake the bringing of buyer and seller together more quickly and less expensively than ever before. Inquiries are to be invited and answered, and by publications for general distribution and by confidential information, the whole industrial and commercial life of the empire is to be quickened.

Possible Electrification

Having set in motion the machinery for stimulating production and distribution, the British Government is planning to bring to perfection the agencies by which this may be accomplished. Much attention is being given to the possibilities of electrical power. A tentative scheme of dividing the United Kingdom into districts in which superpower plants would be erected for supplying motive power and heat has been broached. The theory is that less coal would be consumed, that less labor would be needed, and that a great saving would be effected. In England at least they are not without hope that electricity may prove as great a boon to industry as did the steam engine after the disastrous Napoleonic Wars.

Rebuilding the Merchant Navy

Naturally the most attention is given to the restoration of the merchant navy, for in the past a great fleet has helped to promote the unification of the empire and the carrying charges coming into English pockets have helped to create a favorable balance of trade. Concurrently with plans to enlarge her merchant fleet, Great Britain is arranging for the improving of her harbors throughout the world. New transportation routes are already being decided upon in accordance with plans for the exploitation of certain colonies. At home and abroad railroad and canal development is to be pushed until every productive area has been brought into touch with its market.

Combination and Standardization

Numerous plans are being made for bringing the purposes of the Empire into harmony with the various industries. In general they adhere to the principle of amalgamation, as it is believed that only by methods of quantity production at lower cost, the division of fields both in production and distribution, and concentration of certain phases of the work in accordance with demonstrated skill, can a single industry hope to compete with German concerns.

The idea is clear in the minds of many Britons now that competition after the war will be between nations rather than individuals and that no industry will thrive without the closest coöperation with all others of related character.

Concentrating Capital

The great British banks are aware of the demands that will be made upon them to finance this program of restoration and new developments. By amalgamations they are concentrating great reserves of capital upon which to build a credit structure adequate to the needs of the coming years. These amalgamations are significant of the growing feeling that to win their way—or even to survive—the peoples of the British Empire must draw closer together, socially, politically and economically. As the war has welded them into a compact, coördinating, interdependent fighting machine, so, apparently, is the prospect of wonderful opportunities combined with an appreciation of the necessities of the case, urging them to unity of purpose and breadth of understanding in their preparations for peace.

New York, April 1, 1918

Guaranty Trust Company of New York
140 Broadway, New York

Organizing for the Victories of Peace

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New York, April 22, 1918

Guaranty Trust Company of New York
140 Broadway, New York

The Inspiration of Adversity

The Guaranty Trust Company of New York gives herewith some features of the plans being made by France to meet conditions after the war. This is the third of a series of papers upon the subject of financial and economic affairs in foreign countries, with particular reference to plans for extending their foreign trade.

AMERICA may well look to France for example and inspiration in making preparations for developing her foreign trade after the war. Particularly is this true because France is animated by the hope that her future financial and commercial relations with this country will emphasize the historic friendship of the two nations and give permanence to that mutual appreciation which grows out of present circumstances.

In all history there is no people whose rising to meet a seemingly overwhelming assault upon everything they considered worth while has had such power over the emotions of mankind. They are the glory of the world. To the discerning it will appear also that there has been something marvelous in the complete surrender of the nation as a whole to the idea that every available agency should be utilized for the single purpose of winning the war. The degree of concentration reached has been phenomenal. Through such use of her resources France has been able to sustain every shock of war despite the fact that some of her fairest portions have been overrun by the enemy since the beginning and others are useless except for military operations.

Transforming Emergency into Opportunity

Now, with characteristic mental adjustability, the French people propose to transform emergency into opportunity. In all their preparations for reconstruction after the war there is disclosed an intent to make adversity their inspiration, and to apply to any problem that may arise the principles that have been at the foundation of their efficiency in war. It is their intention to keep under mobilization, for a considerable period after peace comes, that spirit of unity, coöperation and concentration in enterprise that has kept the nation from vassalage during the last three and a half years. Taking account of such a purpose an English observer says that France will probably make greater progress in the next thirty years than any other European country.

Future Economic Relationships

France recognizes clearly the double character of her future problem. She must restore the country itself and reëstablish its necessary and profitable relationships with other countries, and it is noteworthy that she looks to the United States for help in doing both. She proposes to place in this country those vast purchases of raw material, building supplies and machinery which she must have, and which she cannot get from her own colonies, and will not be able to get in sufficient quantities from other nations engaged like herself in the work of rehabilitation. She proposes to pay for these things and to meet the debts she now owes by selling to this country not only an increased quantity of those things in the manufacture of which she excels, but also those things for which this country in the past has looked to Germany. In her present temper France refuses to consider the possibility of resuming purchases of raw materials in Germany, as before the war, and she is so confident of what our feeling will be after more extended contact with the common enemy that she believes we shall rather buy from her than from Germany. Whatever may be the hopes of mankind with respect to a political league of nations after this war, it is evident that in France, as in England, there is a disposition among financiers, manufacturers and business men to eliminate Germany when proposals affecting future economic relationships are under consideration.

The Chemical Industry

In nothing is this better illustrated than in French plans regarding the future of the chemical industry. After taking from Germany for many years those chemicals which enter so largely into her own highly specialized finished manufactures, France intends from now on to develop to the limit that production of raw materials for use in the manufacture of chemicals for which the necessity of war has proved her capacity, and to increase greatly the number of her factories engaged in the manufacture of chemicals. New companies have been organized and capitalizations have been increased since the war began, and special schools are graduating chemists trained technically and practically to enter the industry.

This same desire for economic independence of Germany is characteristic of the Republican Committee of Commerce, Industry and Agriculture which was founded in 1914 under the auspices of the Ministry of Commerce and which has been making an extensive study of economic conditions. This committee has been surveying the possibilities of the French colonies and of friendly countries to ascertain where products formerly imported from Germany are to be obtained. With an acute perception of future possibilities along these lines the French Government is now concluding agreements for materials with countries which it is hoped will prove to be permanent sources of supply.

France's Industrial Fairs

While France has been so nobly absorbed in war it is a further mark of the enormous energy of which her people are capable that from the very beginning of the conflict her industrial and business leaders have kept ever before them the likelihood of a period of intense competition after peace was proclaimed. They have seen that what Germany aimed at was economic monopoly rather than military dominance, and with spirit comparable to that of their fighting men they have set about to thwart that ambition. They know that, immediately the war ends, Germany will drive her ships laden with German goods into every country where she can possibly make a sale. To offset that intention the French are trying now through the medium of great fairs, with their outpourings of catalogues, pamphlets, leaflets, and posters, to acquaint all the world with the excellence of their wares, and also to learn from the exhibits of others where French importers may look for their requirements. Fifty-three groups of manufacturers participated in the 1917 fair at Lyons, and 937 classes of articles were represented. The number of firms taking part in this fair was 2,614, and the transactions totalled 410,000,000 francs. The United States took over 50 per cent. of that business. The eleventh Paris Fair will be held next month, and so many applications have been received that it has been necessary to increase the number of exhibition halls.

At the close of the current year the war debt of France will probably be nearly $24,000,000,000, or about four times what it was before the war. For several years France has been a lender to Russia and the present precarious state of that country has postponed the liquidation of this indebtedness. Probably Great Britain and the United States will make arrangements with their ally calculated to ease this burden somewhat, but even then the task of regaining her financial feet will require time to accomplish.

Elements of Strength

France has certain elements of strength, however, upon which she is relying to bring her through the hard days of rehabilitation and to restore her former prosperity. She has a splendid climate, a productive soil, and a population of industrious and thrifty men and women. With her coal and iron mines, her crops of wheat, grapes, hemp, flax and jute, her skill in the manufacture of leathers, hosiery, cotton goods, glassware and silk goods, her future is exceptionally bright. There will probably pass from view, for a time at least, that France of highly specialized, highly individualized and artistic manufacture to which the world turned for tasteful luxuries. Her leaders look forward to a long period of standardized, quantitative production for the markets of new countries. They expect also to exploit the French colonies that can produce raw materials and absorb finished products. Until her debts are paid France is to become a nation of traders, if those who now guide her thought and aspirations can bring it about. Her people have been schooled to make great sacrifices. They are prepared to make still more.

Strict Control of Foreign Trade

The exigencies of war have impelled France to exercise a supervision over her exports and imports. She has gone steadily toward her goal of bringing foreign trade under the strictest control, as have Great Britain and the United States, and it now appears that the Government is to take advantage of this fact in order to insure the country against any private interference with the proposed rebuilding and rehabilitation. To accomplish revival of industry at home, and the renewal of her foreign relationships, France must have easy and cheap communications with her colonies and other countries. The prime essential is ships, and the plans of France to obtain such a merchant navy are illustrative of the degree of efficiency she has attained in making war measures serve the purposes of peace.

Building a Merchant Navy

All sea-going vessels have been requisitioned for Government service and placed under the orders of the Ministry of Maritime Transport and Merchant Marine. A rental is paid by the Government and an allowance for expenses, maintenance, working capital and other things made. Shipowners themselves manage their fleets, and are encouraged to make them as effective as possible by the distribution of bonuses. When one of these ships is sunk the Government undertakes to replace it.

The Shipping Program

This replacement of ships is a cardinal point in French plans for the remainder of the war and after it. Ships cannot now be built in France. The Minister of Maritime Transport and Merchant Marine holds that to bring materials from the United States or England would handicap French shipbuilders because of the cost of the materials and transportation. This would mean that French exporters would have to pay higher freight rates to the owners after the ships were put into water. This would place not only the exporters but also all French industry under a handicap in the competition for markets that is to follow the war. In the circumstances he proposes that the State shall replace destroyed ships. Only from the Government will shipyards accept orders He contends that the State can buy materials more cheaply, and that therefore it will be able to contract for new ships on a basis that will insure reasonable rates to the trader of the future. The Government contracts to replace ships in this manner within three years after the war is ended. These ships are to become the absolute property of those from whom their equivalents have been requisitioned.

A State-Owned Fleet

On the other hand the Ministry proposes to build a State-owned fleet for the colonies. This fleet will be managed by shipowners, but the State will share in the profits and in the deficits. Hereafter, according to the intentions of the present Government, there will be no more subsidies for ships in which the Government will have no interest. The colonial fleet will be used in the trade of the French colonies, either with France or with other countries, and will be the lever by which the Government will control cargo rates and the selling price of imports. Steps have also been taken to have the fleet now waiting for repairs put into shape for service immediately.

Developing Harbors

With these plans for increasing the merchant navy, so essential to the development of foreign trade, go others for the improvement of harbors. France has today no harbor where ships of the largest type can dock. Many available places are being explored, and plans have in some cases been drawn for the enlargement of harbors and the reconstruction of ports on a scale commensurate with French hopes for a revival of foreign trade. Closely related to this development of ports is the plan to coördinate railroads and shipping lines, especially across the Mediterranean to Algiers and Tunis. All these undertakings indicate the importance which the French attach to making ready, so far as the war will permit, to handle an unprecedented amount of business, domestic and foreign.

Agriculture

While France can not avoid making extensive purchases of building materials and machinery abroad, she will be able, if present plans go through, to curtail largely her food imports. Wheat, barley, and rye are grown ordinarily, but the war has brought many changes and the French people have been getting acquainted with the cheaper cereals. They are trying to appreciate Indian corn, and millet and rice flour are now used in mixtures. Naturally frugal, the French may be relied upon to seize upon any advantages in this line which will solve their problem of living cheaply during the reconstruction period. It can hardly be doubted that the advice contained in a Government report on war economy will be applied in the trying days still to come. In that report it was recommended that every parcel of soil not cultivated be sown without delay with wheat, barley, Indian corn, and oats, and be planted with potatoes and vegetables. It is a country of peasant owners out of whose hoardings many of the war's expenditures have been met. Under the impetus of necessity their heeding of such advice is a foregone conclusion.

Legislation to increase agricultural production is being framed by the Minister of Agriculture. Deserted territory will be brought under cultivation. A back-to-the-farm movement has been inaugurated and bonuses are to be given to those who abandon their ancient implements for modern agricultural machinery.

Reconstruction

France has no such resources of men and materials as have Great Britain and the United States for building a future out of the wreck that has been made of her land, her forests, her mines, her industries, and her shipping, by this war. She has nevertheless a rejuvenating spirit that will carry her far along the path she has chosen. She understands fully that without the most intense application of energy to such resources as she has, increased production, elimination of all waste, and a resolute effort to win foreign markets she will be unable to regain her standing among commercial nations. That effort she is making. She invites the United States to establish relations with her that will be of mutual benefit. There is for this country no greater opportunity for service and legitimate profit.

The Supreme Task Today

There is neither time nor energy to spare in France just now to undertake the vast problem of rebuilding, remaking and reviving her shattered country. Her immediate problem is to repel the invader. With all the strength and resolution they have her people bend now to the supreme task. Over her fair cities and pleasant fields falls the shadow that fourteen centuries ago buried the wealth and learning and culture of Rome beneath the ruin of political and military despotism. This time, however, the destroyer must reckon with elements of unity, moral strength and capacity for suffering such as decadent Rome never knew. France will meet and solve this problem. Thereafter her future is secure.

DUPONT MAGAZINE

Vol. 8 March 1918 No. 3

CHALLENGE *CLEANABLE* COLLARS

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On pleasure bent or at business, immaculate neckwear is no small asset. Soiled Challenge Cleanable Collars are made immaculate instantly. Dirt, perspiration, or weather have no terrors for them —off or on, jiffy cleanable. Every Challenge collar made with a stitch edge, dull domestic linen finish. 18 styles. No-wilt. Flexible. Peaks and buttonholes stoutly reinforced. Ever-white.

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Preparedness Through Advertising

George Frank Lord

Reprinted Through Courtesy of "Printers' Ink"

PREPAREDNESS for what?

Not for war, but for peace.

Never before has a lesson been more thoroughly taught than the lesson of preparedness as an essential to victory in any international undertaking.

This is a war of commercial competition. Such expressions as "a place in the sun" and "the freedom of the seas" are common, and refer to unrestricted commercial activity.

It must be obvious, therefore, that the war of artillery and torpedoes, on, under and over land and sea, is but the prelude for a more intensive and extensive contest for the commercial supremacy of the world.

Volumes have been written about the military unpreparedness of America, a condition due chiefly to our imagined security against foreign attack. But does anyone imagine that in the slightest degree we are immune against foreign commercial attack?

Yet, that is exactly what will follow the war in quality and quantity beyond all precedent. This, the wealthiest nation of the world, will be the Eldorado of impoverished Europe. We must expect and prepare for most aggressive competition, not only on the part of our war-time enemies, but also from our allies.

If, as most of the world prays, this war may prove the death knell of military conquest, all the ingenuity and efficiency of the civilized world and the half-civilized and barbaric as well, will be concentrated exclusively on commercial conquest.

It is well known that Germany has thoroughly organized her industries to recoup her war costs through world commerce. Our gallant allies, the French, have already sent commissions to this country to contract for machinery and tools to restore and improve her manufacturing facilities.

England has always been a world-trader, and her flag has ever pioneered in the hands of commercial organizations. These and other aggressive nations are bound to seek business in the mart where the money is, and that is the United States of America.

Shall we enter this century-long contest unprepared? Shall we dismantle our war-built plants, disband our highly efficient organizations, and retire our war surplus into impotent bank balances? Or shall we instead begin now to build up and expand our peace products to the end that when war ends, let us hope forever, we will be in position to utilize wartime facilities, war-time capital and war-time organization in the manufacture and sale of the materials and merchandise urgently needed by a devastated continent and a world that has been diverted from normal progress for years?

The latter decision seems so obvious that one is at a loss to realize how any farsighted business man can even hesitate in determining his course. The case of the Du Pont company is an extreme one, but its problem varies from thousands of others only in degree.

Contrary to general opinion, military sales are in normal times, a negligible factor of this business. The dependable business of a manufacturer of explosives is the sale of dynamite and blasting powder for industrial and agricultural purposes, and of sporting powder for hunting and trapshooting. But the war in Europe caused a sudden, enormous demand for American military explosives, successfully met by the Du Pont, and later, other concerns, through heroic effort, large investment in plants and equipment and the organization and training of thousands of workers. It is not too much to say that American efficiency in meeting this emergency saved the allies from utter rout in the first year of the war, and hence saved America from the projected attack following the expected fall of France, Russia and England.

This tremendous military business has supplied the Du Pont company with great chemical and mechanical plants, necessitated increased capitalization, the employment of thousands, and the creation of two cities.

What will happen to our sales possibilities when peace comes?

How will we earn dividends on the capitalization war requirements made necessary?

How may we fill the war plants with peace products and give peace employment to the thousands of skilled workers living in the war-built cities?

Surely not by wondering what *may happen* in business when peace comes, but rather by *making to happen*, what *must be* to employ these facilities.

We are now engaged in developing to maximum

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sale possibilities all our old-time peace products: dynamite, blasting powder, sporting powder, pyroxylin chemicals and leather substitutes. We are also entering new but related lines of business: the manufacture of Py-ra-lin, of paint and paint chemicals, of varnish, commercial acids, dyes, drugs and miscellaneous chemicals.

This development calls for extensive, continuous advertising to let all America and the buying world know that the Du Pont company, which they thought was chiefly a manufacturer of military explosives, is really the world's largest diversified industrial manufacturer producing more than a thousand peace commodities.

We are advertising not merely for current sales results, but for the development of future markets. Our advertising is institutional. We are less concerned with the sale of whatever illustrative commodities we may advertise than with selling the Du Pont oval, our trade-mark, and the big idea of Du Pont American industries, designed to play a most important part in the post-bellum development of America and the reconstruction of Europe.

Our advertising effort in 1918 will be double that of 1917, and we expect results will justify continued if not increased effort after 1918. In adopting this policy, we believe we are serving not merely the interests of our stockholders, but of the country, and that this service in commercial preparedness is second only to the service that we can render in helping to win the war.

We have no doubt that many other of America's business organizations will in like manner save permanently for American business the fleeting advantages gained through foreign war business.

This should mean an increasing volume of broad, constructive advertising that will forever establish with the American public America's ability to supply all our necessities, utilities and luxuries, and have plenty left over for the markets of the world

False Thrift

There is a lot of difference between thrift and parsimony. Conservation does not mean patched clothes, niggardliness in diet and curtailment of all expenditures to the absolutely indispensable necessities.

Thrift is essential, but not in the personal, penny-pinching way that many persons mistake for thrift. In war times, as always, we need amusement, the broadening that comes with educational advantages, and some things that, because they are not necessary to life, are commonly called luxuries.

Real conservation lies in the way of elimination of waste, the correction of uneconomic habits and a thorough investigation of costs.

It is not so much doing without things we have been accustomed to having that counts, as it is living so efficiently that we will not have to do without them.

False thrift—a mere curtailing of expenditures—saves nothing in the end. It merely disturbs the producing and distributing industries of the country at a time when they are, at best, passing through an unprecedented crisis.

Postponed expenditures usually cost more in the end. Living efficiently, cutting down waste, saving what was formerly spent without a fair return—that is real thrift.

Game Sanctuaries

The subject of game sanctuaries and their relation to conservation, discussed in this issue by Dr. Joseph Kalbfus, Secretary of the Game Commission of Pennsylvania, is of vital importance to everyone interested in the preservation of American game, whether from the standpoint of the naturalist or that of the hunter.

In some states fishermen have been known to turn the course of a trout stream, leaving the fish high and dry, and after taking as many as they wanted, leaving the rest to rot. This is possibly an extreme instance, but it illustrates the wasteful and unnecessary slaughter of game that has gone on for years in many parts of this country.

Now that the whole world faces a meat shortage, the needless killing of game cannot be permitted. If game sanctuaries similar to those in Pennsylvania were established on the waste lands of every state, it would go far toward meeting the food shortage, by providing an increased part of the meat ratio.

Every precaution should be taken to prevent the needless destruction of game of all sorts.

There is pressing need of protecting game from careless hunters and natural enemies.

Roads of the Future

While we have a very considerable mileage of so-called good roads in this country, it is an undoubted fact that the greater portion are not of a character to sustain successfully the heavy motor truck traffic that is now appearing on them, and which will certainly increase rapidly in the near future. To meet the new conditions steps should be at once taken to formulate a systematic plan not only to provide new roads, adapted to the new traffic, but to maintain them in operative condition. Provision should also be made for the rebuilding of much of the older mileage. What the nature of the construction of these new roads shall be is a matter for the engineers to solve, but there is no question but that there must be better drainage, better material and very much heavier foundations than have ordinarily prevailed in the past, especially as with smooth road surface the speed of these trucks is sure to be greatly increased. England has had her experience in this matter, for, what with heavy traffic added to lack of maintenance, on account of war necessities, there is hardly a main road in the country that is not utterly worn out, although they have been accustomed to build much more heavily than we have in the United States.—*Scientific American.*

PERSEVERANCE

By Leigh Mitchell Hodges

Perseverance is patience guided by purpose and propelled by human horse-power.

It plays no favorites.

With it poverty can be conquered and failure put to flight.

"Victory belongs to the most persevering," said Napoleon—and the man who proved this against him at Waterloo said, "Hard pounding, gentlemen: but we will see who can pound the longest."

When asked by a young man for a recipe for success, Bismarck replied: "You need three ingredients. The first is work. The second is work. And the third is work."

Perseverance is persistence in effort—keeping everlastingly at it with heart, mind and soul firm-set on the desired goal. It offers a free field, and for the man or woman who sticks, it holds out the highest rewards. The required qualities are daring, digging and discounting of doubts.

The common cause of failure is want of application. Each normal individual has within self the means of succeeding. Lack of sticktoitiveness is the father of failure. Yet so powerful is perseverance that when applied even to the most typical offspring of this parent, it can transform a corner-loafer into a corner-stone.

History bubbles over with brilliant examples of men and women who, thru perseverance, lifted themselves from unknown depths to heights of fame.

Without this quality Abraham Lincoln might have died as sheriff of Sangamon County, Illinois, and Thomas Gray, who spent twelve years on his "Elegy Written in a Country Churchyard," might never have got beyond the point of furnishing jingles to the local paper.

The person who thinks success a matter of luck or genius has another guess. Even Shakespeare, who began by holding horses in front of the old Globe Theatre, never could have reached the summit without perseverance

The biggest and best thing about this quality, however, is its usefulness in the ordinary everyday, common-garden variety of life and labor. Just as the constant dropping of water will wear away the hardest granite, so continued effort will overcome any obstacle.

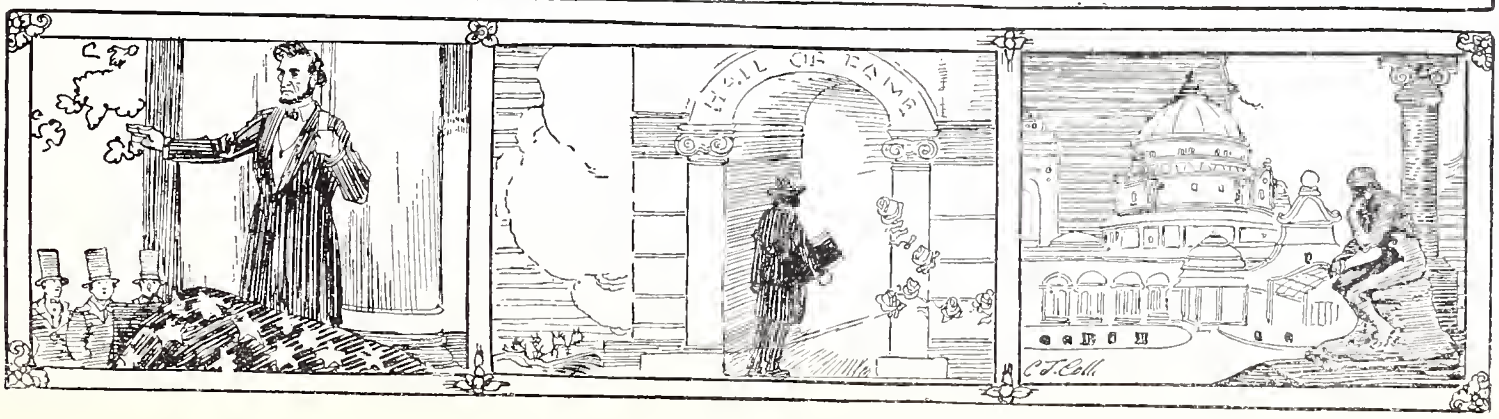
Old Dr. Johnson, sour as a crab-apple and superbly sane, emphasized this fact by saying, "He that shall walk with vigor three hours a day will pass in seven years a space equal to the circumference of the globe." This makes a man think.

What people have said about perseverance, interesting and inspiring as it may be, is not to be compared to what people can do thru perseverance.

Yes, I mean what YOU can do.

What you can do when you keep on after you have come to what may seem the limit of your powers, the end of your string.

And all perseverance means, in the last analysis, is keeping on. *However narrow or steep your path, it will pay you to personally prove this matter for yourself.*



Spring Time is Paint Time

THERE is something in the air in spring time that seems to say to us all "Come out of the kitchen—get ready for summer days—outside days." Even nature, as the first warm rays put to flight the last remaining patch of snow, seems to be tidying up her domain in preparation for the great exodus.

Like Noah, we emerge from our arks after our four or five months of partial confinement and look about us to examine the ravages wrought by winter's storms. Here we notice a broken shutter, there a step that needs mending or perhaps a touch of paint where frequent use of the snow shovel has scraped the surface bare. On the other side, a cellar window with a missing pane or a cornice soiled by water dripping from the roof, meet our gaze and demand attention.

And then come the happiest days of all. With hammer or paint brush in hand we patter about, breathing deeply the balmy air of spring, and proudly watching the transformation taking place under our hands.

Bit by bit the soiled and weather-beaten surfaces disappear until at last in the place of the home we have known, scarred by its battles with the elements, there arises the home we have dreamed of all winter, brilliant in its new dress of paint and varnish, every surface radiating the freshness and brightness of spring.

What an effect the annual rejuvenation has on every member of the family! Heads erect and spirits high, each feels new pride in the improved appearance of the place. For once it becomes the sole center of family interest, and all look forward to the hours to be spent in and about it during the magic summer days ahead.

And now the neighbors, who have looked on with envious eyes, are not to be outdone, and up and down the street in good-natured rivalry paint brushes and hammers fly. Soon the whole neighborhood takes on a brighter hue and all is spic and span to welcome the first days of summer.

Such is the effect of spring!

If ever the annual spring renovation could be done without, it is most certainly not in the spring of 1918. Not only for the psychological effect of new surroundings and bright colors upon us at a time when it is more necessary than ever before that we be of good cheer, but also in the interests of conservation. Spring painting must this year, of all years, be classed as an "essential industry." Not in years have labor and building materials of all kinds been so high in price and so hard to obtain Undoubtedly, for a longer time than any of us now appreciate, new construction and repairs of every kind will be exceedingly costly. Therefore, careful attention to existing property, and this must include frequent painting, is more necessary than ever if we are to protect our present highly valuable property investment and put off for the greatest possible time the necessity of expensive replacements.

Many people do not now realize that frequent painting is not an expense but the best kind of property insurance, but as prices mount it will be more and more obvious that it is more economical to maintain property in good condition than to replace it. While good paint, applied at frequent intervals, will

Painting is Necessary in Maintaining the Dignity of the Home

Color is All Important in Maintaining the Appearances of Town Houses

preserve lumber almost indefinitely, wooden buildings poorly painted decay at an almost unbelievable rate. Painting is practically the only protection the property owner has against this untimely depreciation.

Nor can painting that is needed now be well postponed to a later time. To do that means that in the meantime the surface will be left without adequate protection, and that moisture and the attending decay will gain a foothold. Decay, once started, is almost impossible to stop. And later when the painting is done the surface will be in such poor condition to receive it, that more paint will be required and it will be much more difficult to obtain good results. The inadvisability of postponing painting beyond the time when it should be done to give protection can hardly be exaggerated.

Moreover, anyone who is deferring painting with the idea of waiting for lower prices is making a big mistake. Never has paint been so cheap, comparatively, as it is at the present time. While the retail price has increased from $2.75 a gallon a year ago to $3.50 at the present time, compared with lumber and all other staple commodities it is still relatively cheap. Actually, paint, far from being high, is a real bargain at the present time. How long its present low price will continue no one knows, but there is every reason to believe it is at the lowest level it will be for many years.

The part of wisdom, far from deferring paint purchases, is therefore to anticipate one's needs, and this is exactly what the wise property owner is doing at the present time.

Spring is the logical time for the hundred and one odd outside painting jobs that are necessary to keep a home attractive and in good condition.

Save the Garbage

An increditable amount of grease, fertilizer and glycerin is wasted annually in the United States through failure to properly utilize garbage waste.

Of cities with a population of over a hundred thousand, twenty-five throw away $2,400,000 worth of grease, $1,000,000 worth of tankage, 8,000,000 pounds of glycerin and 200,000,000 pounds of soap-making material. Twenty-nine, with a total population of 17,000,000, discard annually 1,200,000 tons of garbage, which would produce 70,000,000 pounds of grease, valued at $8,500,000 and 150,000 tons of fertilizer, valued at $2,250,000. Excluding cities of 100,000 population and over, the garbage wasted would produce annually 120,000,000 pounds of pork, worth $20,000,000 at prevailing prices. The output of glycerin in garbage now wasted would supply 8,000,000 pounds of nitroglycerin annually and would yield soap stock for the manufacture of 200,000,000 commercial cakes of soap weighing 12 ounces each.

Every city should have its own reduction plant and save this enormous waste.

Auto Used as a Shifter

Recently during a period of unusal congestion in a large eastern freight yard, it was impossible for a large shipper to get shifting engines to place freight cars at his platforms. The difficulty was solved by pressing a light pleasure car into service. Despite the fact that the loaded cars weighed more than twenty-five times as much as the auto, the experiment proved a success, and the trouble was overcome Other new uses for the auto are reported frequently.

Mountain Road Building

H. E. Breed, First Deputy Commissioner, New York Commission of Highways

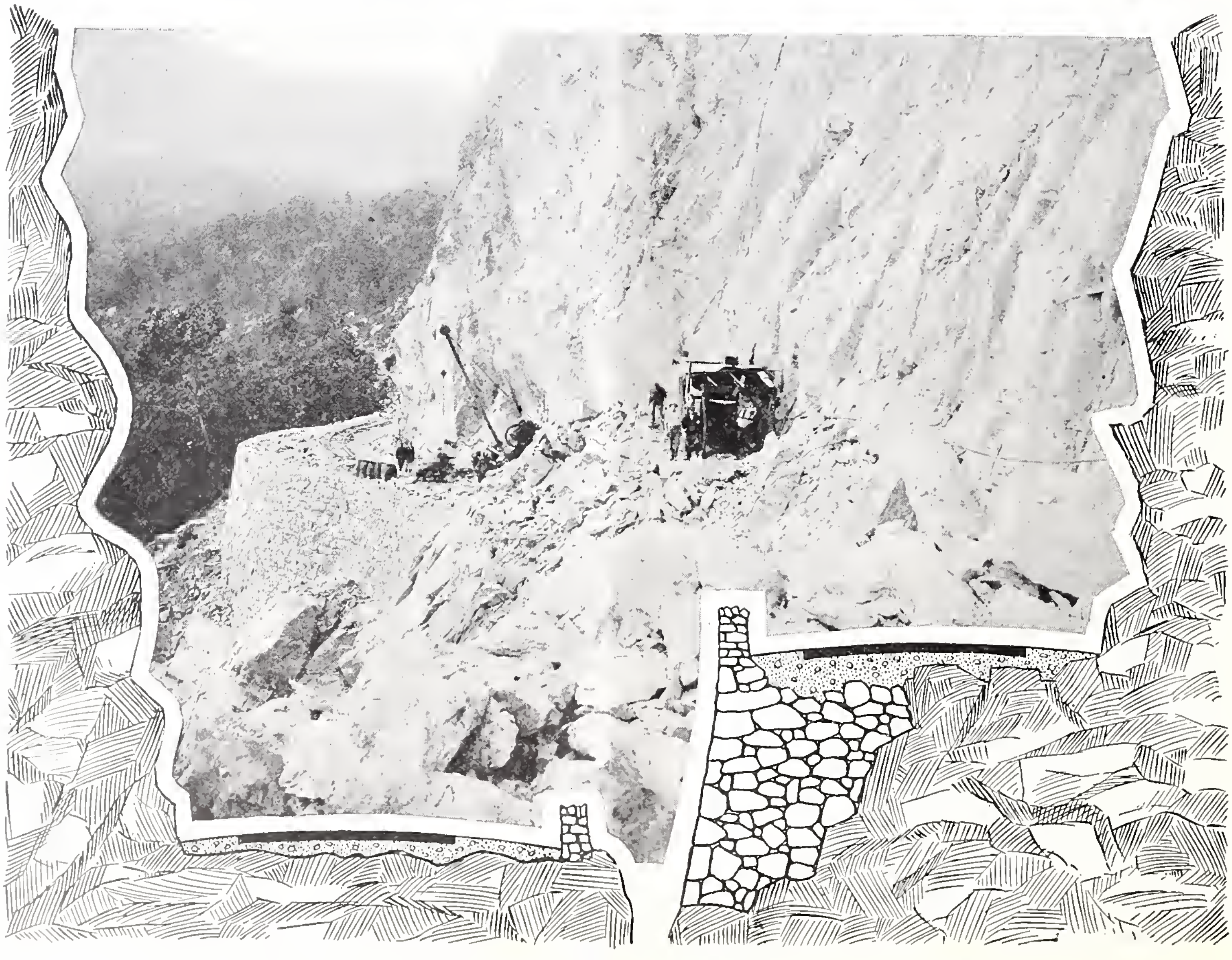
THE mountain roads being built each year in the United States, many of them opening up hitherto inaccessible regions of our country, are constructed in the face of difficulties which are seldom appreciated. In countless instances man's ingenuity and perseverance, aided by modern engineering methods, have triumphed over natural obstacles which until now have been insurmountable.

Such an undertaking is the building of the Storm King Road, the biggest and hardest piece of work ever attempted by the Highway Department of New York State. It illustrates in a graphic manner the unusual difficulties that are encountered in the construction of mountain roads and the methods which have been adopted in order to surmount them.

The Storm King Road is part of the state road that parallels the west bank of the Hudson River between New York and Albany. This route is now broken at West Point, and the only connection further north is over a rough and dangerous mountain path. The Storm King Road when completed will be of great commercial importance, as it will bridge the gap and greatly shorten the highway distance between two important cities, and thereby facilitate commercial travel in a densely populated region. It will also open up a region of great scenic beauty and afford the tourist rare possibilities in the way of vacation travel.

The southern face of Storm King rises practically sheer from the Hudson River to a height of 360 feet, and the cliff at certain points is very irregular and virtually inaccessible. The cliff was so rugged and precipitous that the equipment used had to be unloaded from the freight trains, repacked piece by piece, and drawn up by mules to the site of the work. The rock itself is of such unstable nature, due to erosion, that much of it had to be removed lest it fall from time to time and injure the workers. To complicate the situation even more, the tracks of the West Shore Railroad run at the foot of the mountain, almost directly under the road, so that anything dislodged above would fall upon the roadbed, block traffic, and imperil life.

Due to the inaccessibility of the mountainside, the work of surveying was most dangerous and difficult. The surveying was done in February and March, when the mountain was covered so deeply with snow that it was necessary for the men to work with life belts and ropes. On account of the irregularity of the



A Bit of the Construction Work—The Borders Indicate How the Rock Was Cut Away face of the cliff, the survey could not be made in the usual way, by points taken at the top and bottom of the slope, and it was necessary to mark these places with rockets fired at points on the mountain. In other places a target was dragged over the face of the cliff and raised or lowered to the desired point.

The method of construction was also most interesting. It was begun by cutting into the earth or rock to form the inner half of the roadway, at the same time making a fill for the outer half. In places it was necessary to suspend ropes from above, sometimes to a length of from 200 to 300 feet, to support the scaffolds on which the drillers worked.

About 300 pounds of dynamite was the usual blast in breaking down the rock, but an occasional condition required as much as 600 pounds.

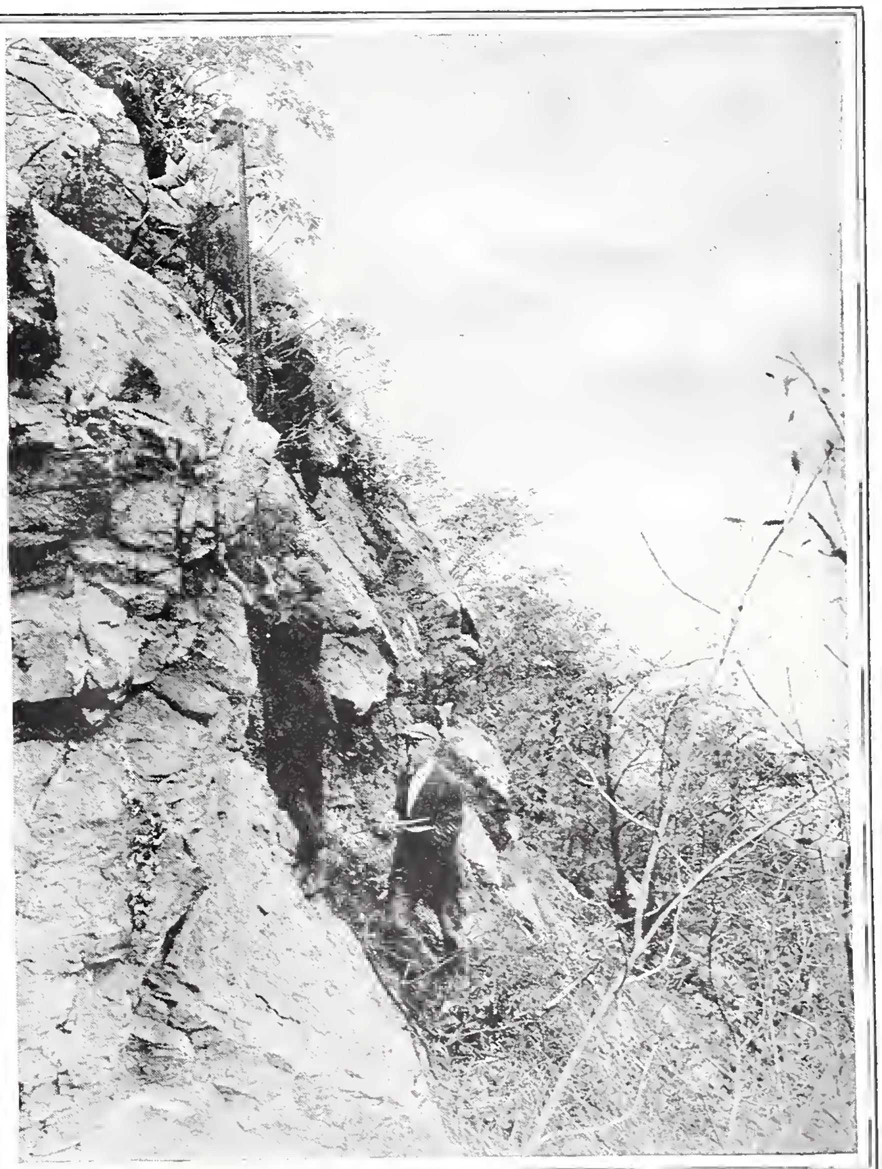
After the blasting had progressed considerably, the wall gang followed, building the supporting wall in sections. The wall footings were blasted out first, and a thorough examination made to see if dangerous cracks had been developed. Often it was necessary to go down a second or third time in order to secure a solid rock foundation. A strong masonry wall four feet high was built as a foundation to carry the dry masonry wall, which was brought to within a foot of the road and was topped with a masonry parapet wall built four feet above the road level.

The roadway when completed will be twenty-four feet wide with a sixteen-foot bituminous macadam pavement. The greatest depth of rock cutting is 130 feet, measured from the inside ditch to the top of the cut. The retaining wall at its highest point measures 50 feet. The deepest fill, which contains about 90,000 yards of material, is about 75 feet. There are 119,000 cubic yards of excavation; 50,000 cubic yards of ledge rock; and 25,000 cubic yards of stone masonry.

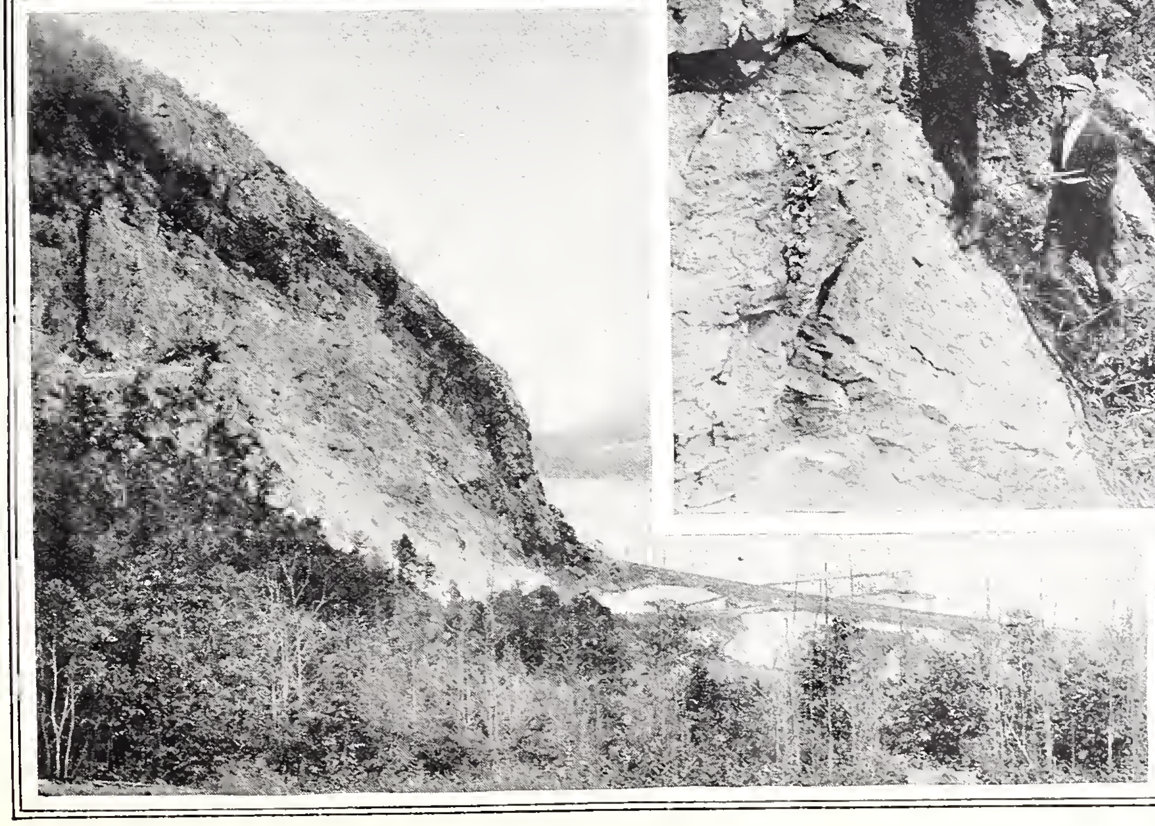
Most of the difficult work has already been done—enough to assure that no insurmountable problems will be confronted. Work on the road has been so encouraging that it is hoped to complete it before the end of 1918.

The building of the Storm King Road is but one instance of the successful application of modern methods of construction to the difficult engineering problems presented in road building.

The Storm King Road will be of considerable military importance. It is situated in a region now badly congested with military traffic—a condition which is likely to become worse as the war progresses and the strain upon our railroads increases. Its completion will provide a much-needed through highway between Albany and New York.



The Surveying Party at Work



Where the Road Led Along This Cliff

Iron the Civilizer

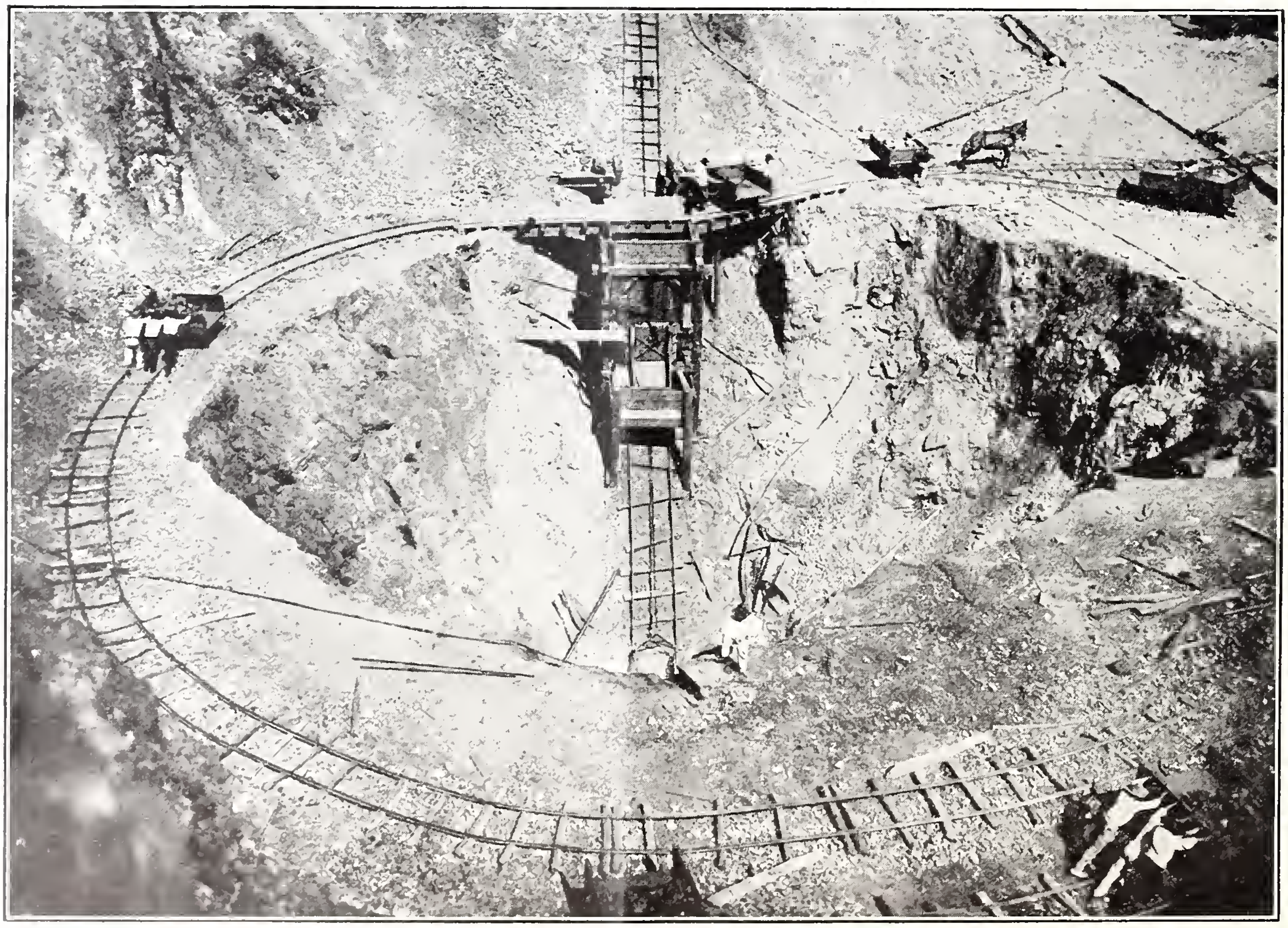
IT was in one of Dr. Steele's text-books, "Fourteen Weeks in Chemistry," I think, that he called attention to the fact that iron is the most valuable metal known. Gold has only a fictitious value as a medium of exchange, and its rarity precludes its use for other purposes, although if it were sufficiently common it would doubtless make good frying pans, forks and spoons, and wires for conducting electricity. The same is true of silver, and it is said that some multi-millionaires use this metal to make the pots and pans in their kitchens. Dr. Steele called attention to the fact that no metal is so enhanced by working as iron; that a pound of it worked up into hair springs for American watches is worth several thousand dollars, while a pound of gold is worth only about $300.

On one of the old Indian trails in northern Canada, there is a canoe portage which exposed native silver, several inches wide, polished bright by the dragging of canoes out of one lake to be carried over to another. The Indians no doubt noticed this metal, but, finding that it would not take an edge and required a very high heat for melting, lost interest in it and left it there. On the other hand, a mass of meteoric iron which fell somewhere near the Arctic Circle and which Admiral Peary brought back to the American Museum of Natural History, had been visited for years by the Eskimos, who laboriously sawed and chiseled off pieces of this precious metal to make into knives, spears, and possibly fish hooks.

It is probable that iron is the earliest useful metal known to man, pieces of it in the form of knives having been found in the Pyramids of Egypt, and although bronze implements antedating this have been found, there is little doubt but that the propensity of iron for rusting, disintegrating and being lost is responsible for its not being found among the implements of prehistoric man.

Certain African tribes in the interior of the continent who have never seen a white man, who never come in contact with other tribes, and who are at present almost in the Stone Age, have been found by explorers working a crude furnace by which iron ore and charcoal were smelted down by the aid of a crude bellows.

The knives and spears made by these savages and used for hunting, and possibly for war, bring out quite forcibly the part that iron has played in the history of nations, especially with regard to its use in warfare and the necessity of its possession by any nation aspiring to lead the world either in peaceful arts or in war. In historical times, the superiority of the steel swords made in Spain and used by Hannibal at the battle of Cannae was probably responsible for his victory over the Romans, who did not make as



The Entrance to a Rather Unusual Iron Mine

A Cuban Iron Mine Where the Ore is Removed in Terraces

good a grade of steel. The fame of the old Toledo blade and the Damascus blade is familiar to every schoolboy, and the possession of one of these blades was the ambition of every swordsman in the Dark Ages, when the art of making them had become lost.

Until the year 1890 the British Empire produced more steel than any other nation, and her leadership in commerce and manufactures during that period was unquestioned. Since then the United States has manufactured more steel than any other nation, and at the present time bids fair to eclipse Great Britain as a commercial nation, as she has already eclipsed her in manufacturing.

It may have been the desire on the part of Germany to obtain possession of the iron mines in Lorraine, at that time the only known deposits of iron ore in France, which prompted her to make war upon France and seize this territory in 1871, and it may have been the desire to possess the iron mines, with the equally essential coal deposits of Belgium and northern France, which prompted Germany to strike at that point instead of through Switzerland at the beginning of the present war. At any rate, the prime necessity for the successful prosecution of a modern war is steel, and more steel, and still more steel. It is the steel shell, the steel shrapnel balls, the steel cannon, the steel rifle, the steel ships, and the steel rails, and their possession in superabundance which seems to be the deciding factor in modern warfare.

Now, where does all this steel come from? Germany with her conquered provinces produces about 30,000,000 tons of ore per year; Great Britain not quite this much; France very much less; and the United States nearly 100,000,000 tons.

The greatest single producer of iron ore in the United States is the wonderful Mahoning-Hill-Rusk pit near Hibbing, Michigan. In this deposit, the rich ore is so soft and so penetrable that after it is broken loose by blasting it can be dug almost like so much earth by means of gigantic steel shovels, loaded directly on to cars, and brought by the Great Lakes almost to the doors of the blast furnaces.

Blasting powder is used to loosen these ores so that they can be handled by the steam shovel. For economy in mining—that is, for low cost of producing the ore—no deposit in the world compares with those of the Mesaba Range in Minnesota, in which this wonderful pit is located.

Besides the open pit mining operations of Mesaba Range, there are a great number of deep iron mines in which the ore is mined economically by the aid of vast quantities of dynamite. Ores containing a higher percentage of iron are contained in other parts of the United States, notably the Gogebic Range in Wisconsin and Michigan, the Champlain district of New

Mahoning-Hill-Rusk, the Largest Iron Mine in America. The Opening Shown is Almost a Mile Wide

York, and some of the iron mines in New Jersey and Pennsylvania. All of these are hard haematite or magnatite and require the use of explosives to mine them.

One of the most remarkable deposits of iron ore in the world occurs in the Birmingham district in Alabama, where two ridges or small mountain ranges run parallel; one containing rich iron ore; the other, only a few miles distant, containing vast deposits of coal; while in the middle of the valley are great quantities of limestone; so that the three essentials for the blast furnaces—the iron ore, the fuel, and the flux—are found side by side. In this district, the cost of producing steel is so low as to make an European statesman weep. But it must be remembered that this low cost of production, even in this most favored region, could not be realized if there were no explosives on hand to enable the miner to win the ore, the coal and the limestone. In the rich ore deposits of magnatite and the so-called "steel" ore of northern Michigan, the ore is so hard that without the use of modern explosives the miner would be utterly unable to produce any ore whatever.

Given the essential raw materials—ore, coal, and limestone—conveniently located, there is still required labor, capital, and brains to produce the finished product, steel. But in this catalogue of the essentials, it is not often realized that there is another essential without which labor, capital, and brains could not evolve steel from ore, fuel, and limestone; this essential is explosives.

Keep Up the Highways

This is no time for a letting up of highway construction and maintenance. The nation has never been in such need of good highways and connecting roads as now. As the war goes on, more and more of our transportation will have to be done by motor truck. The army supply and transport service and postal service both require, to a constantly increasing degree, an unbroken chain of interurban communications.

Poor highway surfacing and grading mean increased cost of motive power, costly wear and tear on valuable equipment and expensive delays.

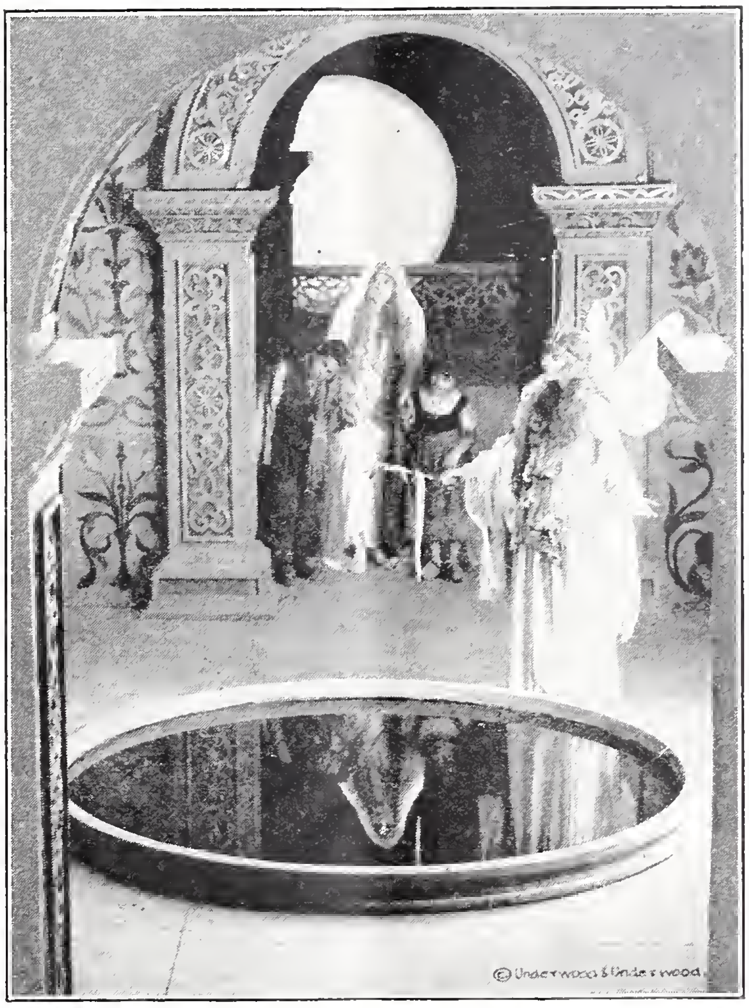
A Well-Graded Highway

Evolution of the Mirror

IN legend and history it is told that the first mirror was contemporary with the first woman. Whether or not this was a coincidence or a special dispensation of Providence will never be known. At any rate, from that time forward, in every age, the lady and her mirror have been one and inseparable.

Some men have also been accused of succumbing to the charms of their reflected glories.

When Mrs. Eve wished to note the effect of her latest leafy creation, it was comparatively an easy matter. She repaired to the nearest pool, there to behold all her beauty in its crystal surface. This was a simple arrangement, and one that would, undoubtedly, find supporters at the present day. Unfortunately, or perhaps fortunately, ideas change, and with increasing traffic about the community pool complications arose that made necessary an arrangement somewhat less romantic, but more in keeping with the social precepts of today.



A Fountain Used as a Mirror

The first mirrors for individual use, shown in the leading department stores about 700 B. C., were metallic—usually of tin or bronze. A thin and slightly convex disc of metal was polished on one side and on the other left plain. It was strictly a utility and laid no claim to beauty. Silver mirrors have also been found, which it is thought were in use at the time of Pompeii. This type of mirror is still in existence as a part of the field equipment of the boys at the Front.

In size the metallic mirrors of the ancients were not unlike the hand mirrors of today, though the early examples have no handles. These sufficed until the time of the Roman Empire, when one fine day the first lady of the land was seized with the notion that she should be able to view her figure "from head to toes" instead of only a part of it. So a craftsman of the court, his wits made nimbler by the "strafing" to be administered if he did not produce, evolved an ingenious arrangement whereby a piece of metal could be lowered or raised like a window sash so as to take in the whole figure.

The first mirrors to have handles like those of today were used in Greece. Usually the handle was carved, often in the form of a miniature statuette of Aphrodite. Others were even more elaborate. A little trinket gotten out for the holiday trade in 400 B. C. was a "vanity mirror" of metal, consisting of two circular discs, fastened together with a hinge, the upper one ornamented on the outside, the lower one polished to reflect the face.

In ancient Greece mirrors were used for divination as well as for their powers of reflection. The custom was to lower the mirror into a well until it grazed the surface of the water with the rim, when it was pulled up and, when looked into next, showed the face of the person who would benefit by this ceremony.

During the Middle Ages, the society lady carried her little metal mirror at her girdle or in an embroidered pocket. The pocket mirrors were small plaques of a brightly polished metal—usually steel or silver—fitted in a small, circular box and covered with a lid. The mirrors worn at the girdle had no cover, but were furnished with a short, ornamental handle.

It was not until 1250 that the practice of using glass backed by thin sheets of metal for mirrors was inaugurated, but it developed rapidly. In 1373 a guild of glass mirror makers was formed and small globular mirrors, called "Bull's-Eyes," were turned out in great quantities by the use of blow pipes.

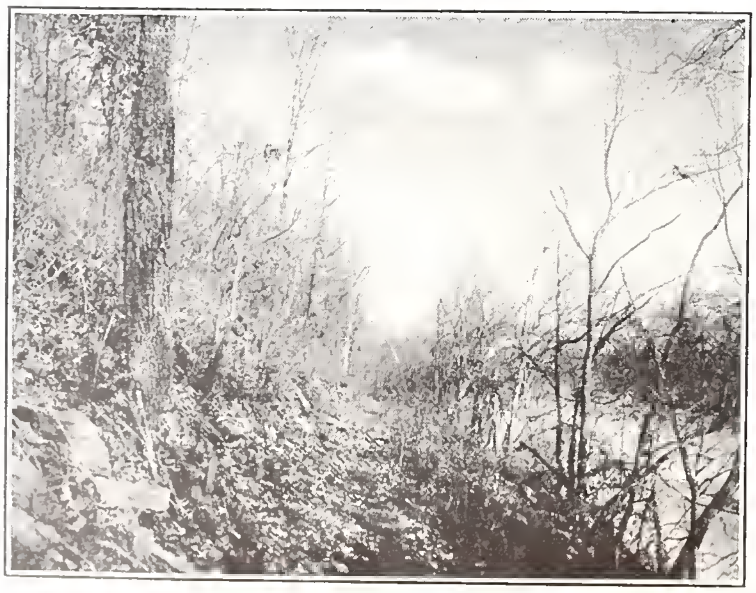
The credit of being the first to develop the making of fine mirrors on a commercial scale is given to Venice. For a century and a half that republic enjoyed practically a monopoly of the art, and Venetian glass mirrors were without an equal. The Venetians were jealous of their trade and had a little way of protecting the home industry that was novel, but effective. It was the law that if any glass maker carried his art to a foreign state, emissaries were delegated to pursue and slay him. That these minions of the law usually got their man is very apparent, for it was not until 1664 that any other country succeeded in spiriting away any of the Venetian workmen. At that time, Colbert, the French Minister, induced twenty Venetian glass makers to take up their residence in France. As a result of this and of the development of plate glass in 1691, the mirror industry in France grew rapidly, and French mirrors soon excelled those of Venice in quality.

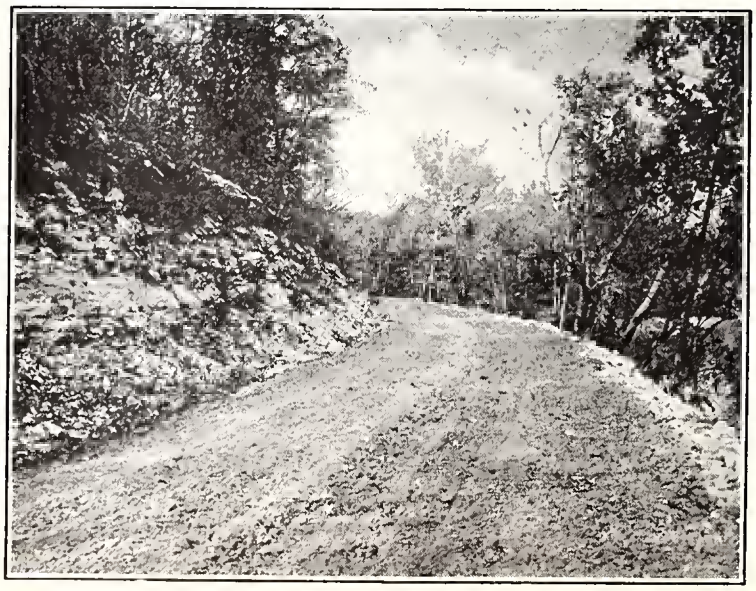
Copyright Underwood and Underwood

Since the adoption of glass mirrors, many rare and beautiful metals and materials have been used for cases. Gold, silver, enamels, ebony, and other costly materials, often set with precious and semi-precious stones, were used.

From time immemorial ivory has been the most prized of all materials for mirror backs and many other dainty and exquisite articles of the toilet. Today, in ivory py-ra-lin, the modern substitute for ivory, there is the counterpart of the ivory of old. Its chaste coloring and delicate graining place it beyond comparison with any metal in grace or charm. Its soft, creamy, untarnishing surface lends itself completely to the engraver's art, and its loveliness has given it a perpetual place of honor in the boudoir. It lends itself to exquisite monograms of any design or color. The background may be etched to bring the desired pattern out in beautiful bas-relief. Hand carving may be added to produce effects unique and charming.

A Road Transformation





Solvents for Nitrocellulose

John N. Hans

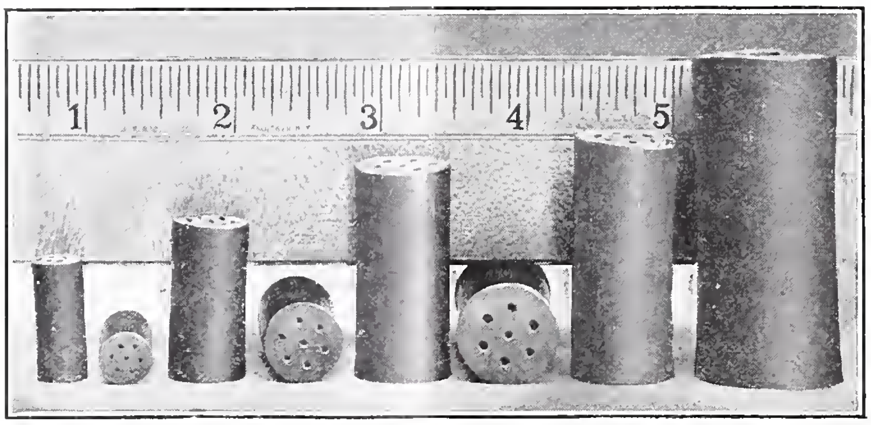
No doubt the word "Solvent" is one which, to many of us, is confined largely to use in laboratories and dry scientific books. Colloquially the word is seldom used, and but little do we realize the frequency with which we come in contact with the work of solvents in the course of our daily routine. For example, to our morning cup of coffee we add some sugar, and in a moment the sugar seems to have disappeared—we say it has dissolved—and our coffee is the more palatable. Or to a glass of water is added a little of salt, and in a few moments the salt is no longer seen, although our taste will tell us it is there. We say we have a solution of salt. In other words, the water has exerted its solvent action and the sugar and the salt are no longer solids, but act like a liquid itself. Water is then a solvent, and indeed it is the most common of solvents.

In the nitrocellulose industry there are many solvents used for dissolving the cotton, just as the water dissolved the sugar, and converting it into other useful compounds. Nitrocellulose is, as has been seen in a former issue, similar to ordinary cotton in appearance and is a chemical compound obtained by treating cotton with a mixture of nitric acid and sulphuric acid, sometimes called "oil of vitriol." And were it not for solvents, the nitrocellulose industry would never have reached the plane which it occupies today. They are used in the manufacture of py-ra-lin; such leather substitutes as fabrikoid, collodion, lacquers and smokeless powder. The more important are amyl acetate, ethyl acetate, acetone oil, commercial wood alcohol, methyl acetone, acetone and a mixture of ether and ethyl alcohol. These can be divided roughly into solvents for nitrocellulose to be used in the arts, and solvents to be used in the service of Mars. Prior to the present war, the American industries made use of the former class to a much greater extent than the latter. For it was the peaceful rather than the warlike side of these industries that received the greatest efforts; and while at the present time the manufacture of smokeless powder and the winning of the war is uppermost in the minds of all, when the Dove of Peace again makes her appearance among the haunts of men, it will be to the business of peace that all industries must look for stability and prosperity.

Most of the solvents mentioned have lowly origin and come from the most commonplace materials. Several are obtained from wood by a process known

A Plant Unit for the Preparation of Solvents and Cotton Solutions

as "destructive distillation." The wood, which is the hardwood waste of saw mills and lumber camps, is placed in iron vessels or retorts and heated gradually to a temperature of 800° Fahrenheit or more. A pipe connected to the retort and running through a tank of cold water serves to remove all the vapors which are given off by the wood. As these vapors are driven through the cold portion of the pipe, some are condensed to form a liquid to which has been given the name of "pyroligneous acid"; others, when further cooled, form a tarry substance and are called "wood tar." Still others remain as vapors or gases and are burned under the retort. When the temperature of the retort has reached a sufficiently high degree, it is allowed to cool, and the residue—charcoal—is removed. The liquid pyroligneous acid is met with unslaked lime, forming acetate of lime, from which acetone and acetone oil are obtained. Further rather intricate treatments yield commercial wood alcohol and methyl acetate.



Grains of Cannon Powder

Ethyl alcohol, commonly called "grain alcohol," is derived mainly from starchy materials, such as cereals and potatoes. Other sources are molasses and sawdust. The starchy materials are washed and steeped in hot water, which causes the granules of starch to swell and burst. Malt, which is simply grain which has been allowed to sprout and then dry, is added. This contains a body called "diastase," which changes the starch to sugar. The addition of yeast to the sugar forms alcohol, which is purified by distilling.

A large plant, devoted exclusively to the manufacture of grain alcohol from green pine sawdust, is located at Georgetown, South Carolina, and its success is a monument to the perseverance of the industrial chemist in his search for sources of materials other than from food products.

The liquid residue left after the alcohol has been removed by the ordinary methods of distillation contains a small percentage of amyl alcohol, which is removed and treated with chemicals, derived from the distillation of wood, to change it into amyl acetate. It has a very pleasant pear-like odor, and before the passage of the Pure Food and Drug Act was used to some extent as a fruit essence. The same chemicals used in changing amyl alcohol into amyl acetate are used to convert ethyl alcohol into ethyl acetate. This latter also has a pleasant fruity odor, and was formerly used to some extent as Essence of Apple. These are both important solvents in the industry.

Ether occupies the peculiar position of being used in the manufacture of smokeless powder for the Allied armies, and being also used by the surgeon in the operating room in his efforts to restore and rebuild. It is made by bringing grain alcohol in contact with hot sulphuric acid, whereby a chemical change takes place and the alcohol becomes ether.

All these and many other equally interesting chemicals, and the most painstaking methods of combining them, are necessary in developing the dissolved cotton industry.

The Day of the Leather Substitute

THE war has brought about many changes in our industrial life. Many of them are makeshifts which are undoubtedly with us only for the duration of the war. But by far the greater number are improvements over previous methods, the benefits of which we will continue to reap long after the war is over. That necessity is the mother of invention has never been more clearly demonstrated than in this present emergency, which for a time threatened to suspend our most vital and fundamental national activities, but which has instead developed, as nothing else could ever do, the full power of the nation's resourcefulness. Under the spur of necessity we have in the last three years overcome time and again seemingly insuperable obstacles, we have accomplished in countless instances things that we have until this crisis considered impossibilities; we have learned to do nearly everything more efficiently and more economically.

Foremost among those changes which will result in establishing American industries on a more secure and more permanent basis following the war than they have ever been before is the substitution of materials the value of which has been previously little known or appreciated for other materials, the supply of which has been cut off or greatly diminished by the abnormal conditions which have developed and are likely to continue as a result of the war.

The growing realization that in many instances there is not enough of food or materials to go around, the diversion of materials from their ordinary purposes to the new uses of war, the resulting shortages that have developed in materials and supplies, hitherto used with a lavish hand, has resulted in a conscientious searching for materials having the same virtues and qualities which, by their general adoption, might increase the available supply of like materials to a point sufficient for our needs. In a majority of instances such materials have been found and the fact that many of them have hitherto been unused or used to little advantage, and that a great many others have been found more suitable for the purpose, price and availability considered, than the material which they have replaced, is evidence that this general tendency toward substitution of one class of materials for another with the same general characteristics has resulted in a real economic gain.

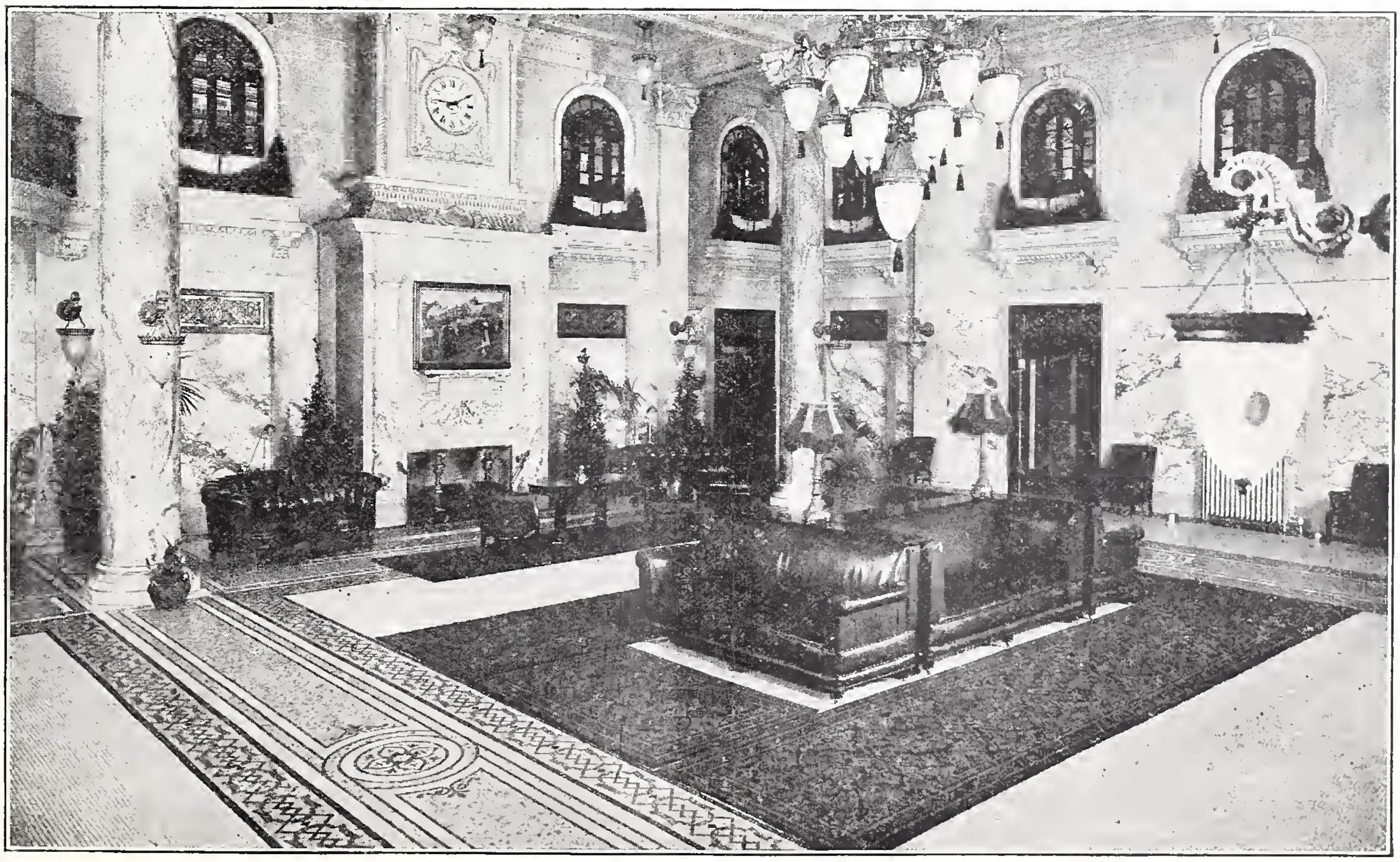
In view of the foregoing it should not be assumed that the leather substitute—by which is generally meant a cotton base fabric, coated with a pyroxylin solution, colored and embossed with the natural grain—has come into use because of conditions created by the war. It has not. Artificial leather has for many years had an increasing use in many and various industries. It does, however, owe, in large measure, to the war its almost universal adoption as a substitute for leather in the home and in nearly every manufacturing industry of size, and the growing realization that for most every purpose it is the equal and in many cases superior to any but the very highest quality of natural grain leather. It is in every way a superior product for upholstering and miscellaneous purposes, and it is in these industries that its use has met with the greatest favor.

The diversity of the uses to which artificial leather is being put at the present time is little short of astonishing. Practically everywhere that leather can be used its counterpart, the leather substitute, finds employment. In furniture and automobile upholstery, automobile and carriage tops, bags and suitcases, book binding, trunks, camera cases, manicure, jewelry and instrument cases, hand bags, harness, clothing, gloves, puttees, counter mats, gun cases, pillows, hats, toys, belts, storm aprons, base-balls, leggings, shoes, military vests, car curtains, vestibule curtains and novelties of every description, it has largely replaced leather with the most satisfactory and economical results.

By far the greatest use of leather substitutes is in the manufacture of automobile and carriage tops. It is estimated that in this industry alone 25,000,000 yards of leather substitutes are used annually. This includes not only imitation leather of the pyroxylin type, but also the various rubber-coated materials used chiefly in carriages and low-priced automobiles. Leather, which at one time was the sole material used for high-grade vehicles, has now been replaced in this industry almost entirely by leather substitutes, which have been found more satisfactory because of their lighter weight. The adoption of leather substitutes in this industry has resulted in great economies, and has released enormous supplies of leather for other industries where its use is indispensable.

In the upholstering of automobiles another 10,000,000 yards of leather substitutes are used annually. Over 75% of the popular-priced automobiles manufactured in America in 1917 were upholstered in leather substitutes of one kind or another. Because of its greater tensile strength and wearing qualities artificial leather is fast displacing leather splits in this class of trade.

In furniture upholstering leather substitutes are now the choice of the most discriminating manufacturers, furniture dealers and purchasers of high-

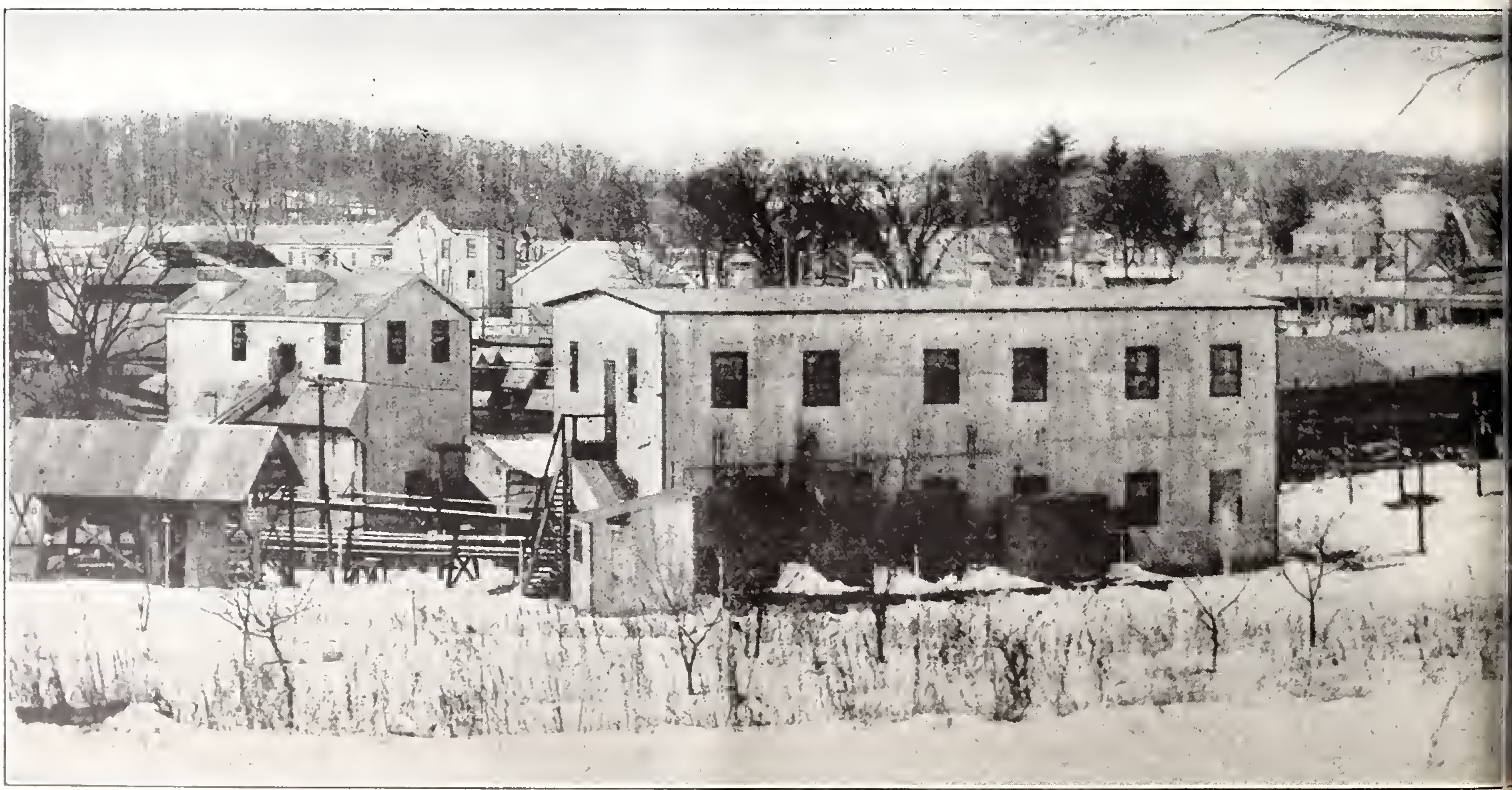


A Sumptuous Interior Finished in a Leather Substitute

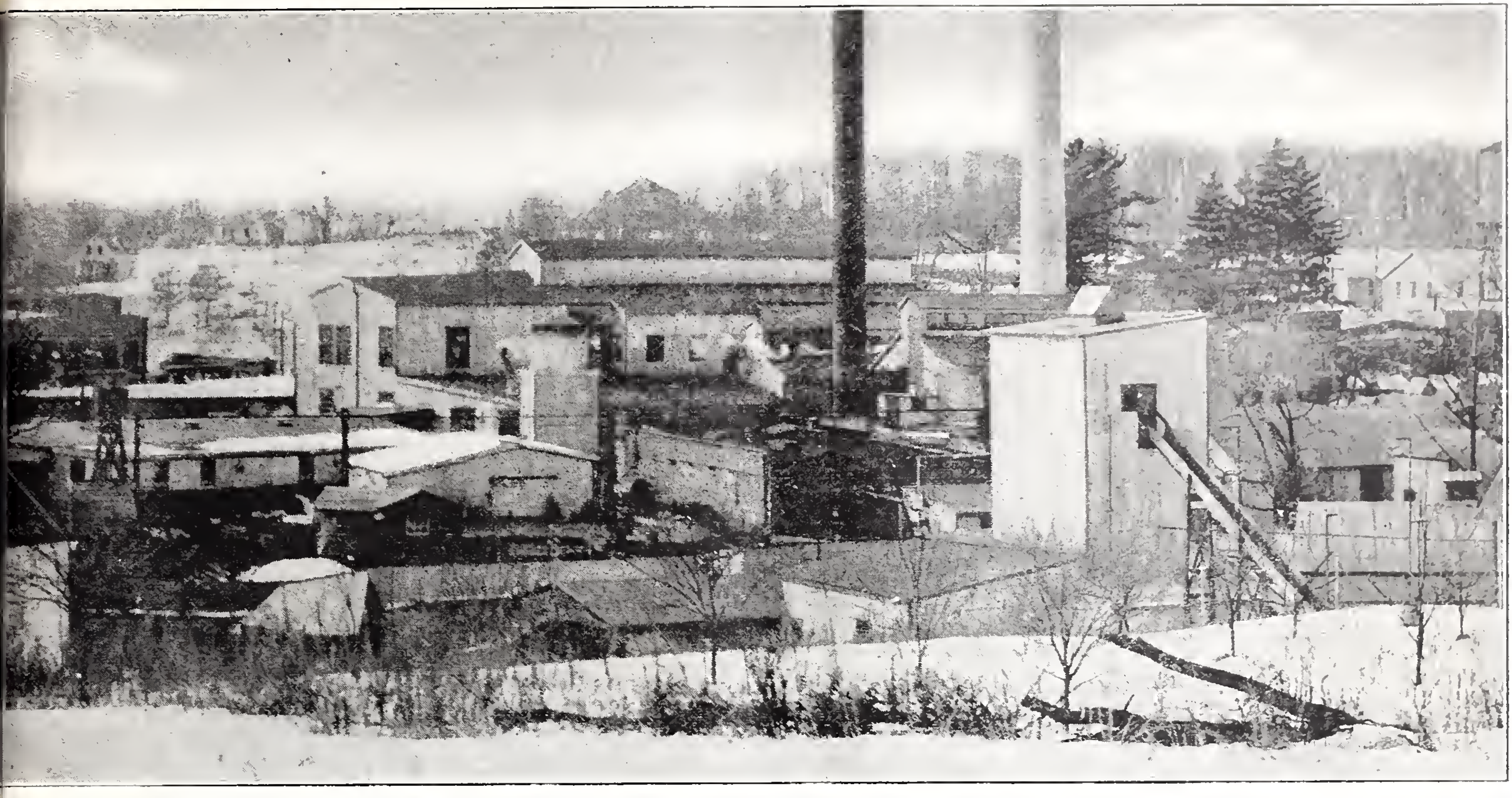
grade furniture. Their great economy over natural grain leather and superior wearing qualities over split leather has made it the logical material for furniture upholstering.

In bookbinding, literally millions of yards of artificial leather are used annually. Exact figures cannot be obtained, but it is known that the use of artificial leather for bookbinding is increasing annually with leaps and bounds. Whereas even genuine natural leather will decompose in time, even if untouched, artificial leather is practically unaffected by moisture or decay. It also has the quality of being insect and rat-proof, which makes it valuable as a protective covering for rare volumes.

Another use of artificial leather, important as it is unexpected, is in the manufacture of hat sweats. In 1916, 127,000,000 hat sweats were made in the United States alone, and it is estimated that half of them were made of artificial leather. The tremendous saving in leather for other industries can be imagined.



This Enormous and Ever Growing Plant is Devoted Exclusively to



But a few of the many uses of leather substitutes have been mentioned—enough, however, to give some idea of the vast quantities of leather that are released for indispensable industries by their use. The present emergency requires the utmost conservation of leather if our armies are to be properly equipped. Our government, following tests which fully demonstrated the economy and superior service qualities of leather substitutes over leather for many uses, has taken the lead in the conservation of leather by specifying artificial leather for the upholstering of our fighting craft and the ships of the new merchant marine. It is not only to the advantage of the manufacturing and consuming industries to follow suit. It is their patriotic duty.

The use of leather substitutes for upholstery, tops, bookbinding and the thousand and one miscellaneous uses for which it is so well adapted means that leather will be available in sufficient quantities where it is necessary and indispensable—in the shoes and equipment of our armies.

ture of Leather Substitutes that are Relieving the Shortage of Leather

The War to Win the War

"SEND us food and then more food," is the cry of war-torn Europe. All authorities who have studied the war conditions say that food will win the war; that the side which can the longest continue to feed its fighting forces and its civilian population will be the ultimate victor.

The war in Europe is playing havoc with farming over there. Millions of acres of Europe's farm lands are idle and probably will remain idle for years after the conclusion of the conflict. This condition puts it up to America to produce food enough for all and she can do it because she has the land, provided every acre of it is cultivated and forced to maximum production. The millions of acres of cut-over land and swamp land that now occupy parts of our country should be included in the cultivated areas.

Think of what it would mean if the 400,346,575 acres of unimproved land in this country were put to work producing crops. Beneath the stumps and rocks is concealed a gold mine, and there is more profit to be derived from the mining of farms than from the mining of mountains. The ground occupied by one average stump will produce from twenty-five to fifty cents' worth of food per year.

The cost of clearing land must be paid but once, whereas the profit derived from it will go steadily on through generations. Cleared land is virgin soil which for years after the clearing and "taming" will yield bumper crops, with minimum expense for fertilization. Expenditures for land clearing are permanent investments that will be returned many times over in profitable crops.

Recently President Wilson addressed several hundred representative business men attending the annual convention of the Chamber of Commerce of the United States. He said he wanted to convey to the farmers throughout the country the necessity of cultivating more land. He said:

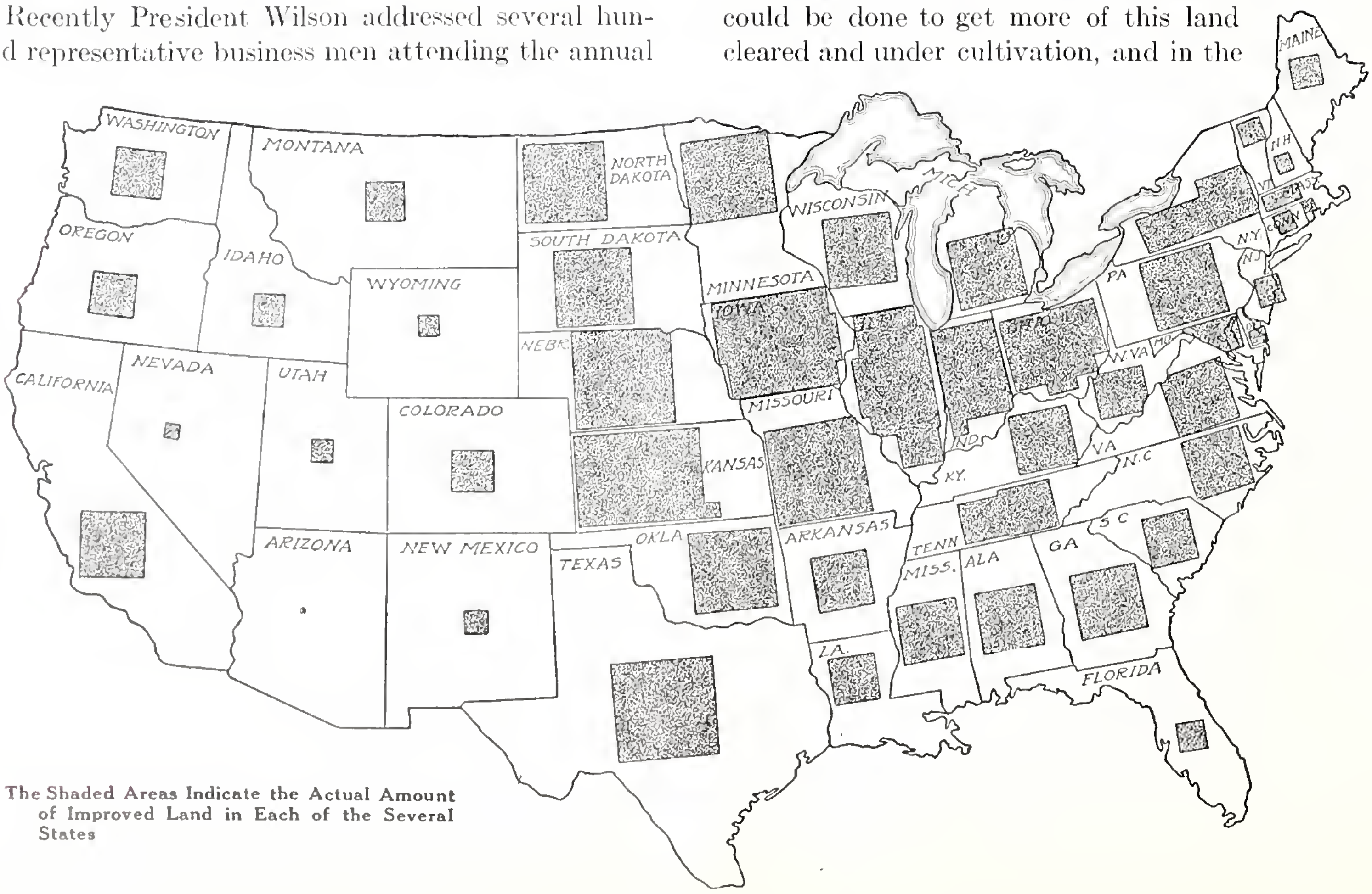
"There is a shortage of food in the world now. That shortage will grow constantly more serious. It is necessary that there should not be a plow or spade idle in this country if the world is to be fed."

Mr. Herbert C. Hoover, the National Food Administrator, feels that the Du Pont Company's advertising is a valuable aid to the Food Administration because it preaches the doctrine of more land clearing. In a letter written to our President recently, Mr. Hoover said:

"Mr. Maxwell, the head of our Outdoor Advertising Department, has shown me the rough proofs of two of your advertisements for farm papers, and it may be in order to express my appreciation of this indirect, but nevertheless substantial, support of our efforts tending to increase our production and conservation of our great grain harvest, looking toward the successful termination of this war."

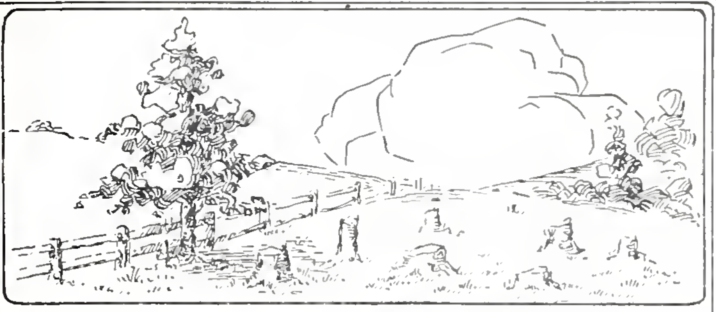
The University of Wisconsin is one of the country's greatest educational institutions. However, it is more than a mere school. With characteristic altruistic viewpoint, it is interested in the development of the State. Wisconsin is a region famous for its production of grain, potatoes and dairy products, everywhere recognized as among our most important food products.

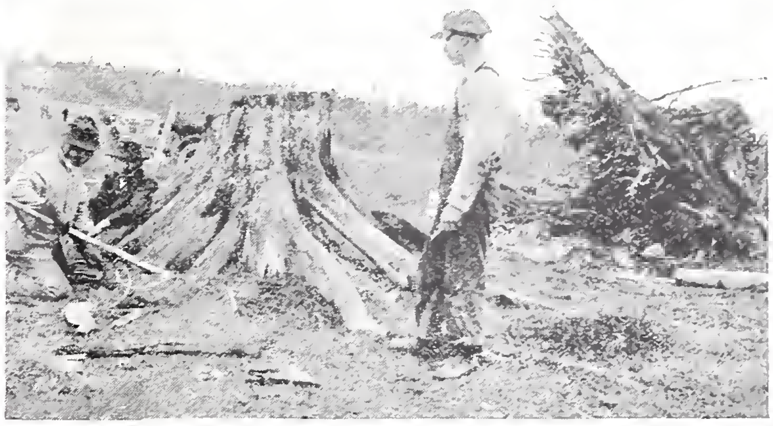
In Wisconsin there are still thousands of acres of very fertile cut-over land. With its usual commendable enterprise, the University set about to see what could be done to get more of this land cleared and under cultivation, and in the



The Shaded Areas Indicate the Actual Amount of Improved Land in Each of the Several States

LECTURING TO THE CROWD



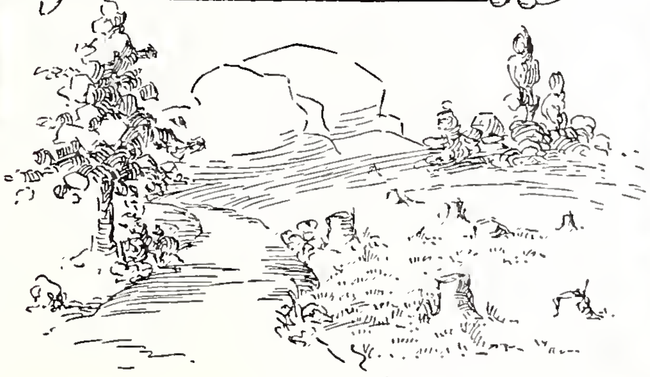


LOADING THE STUMP

THE BLAST

FIELD OF STUMPS AFTER BLASTING

THE STUMP PILER

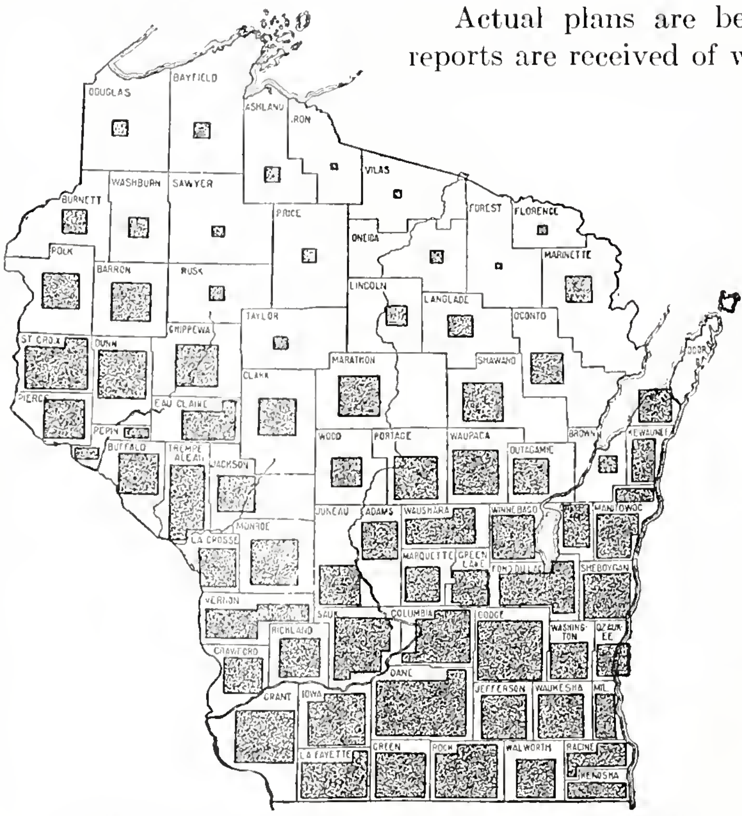


THE LAND CLEARING SPECIAL

spring of 1916 before the United States had entered the war, sent out an agricultural engineer to locate points for large public land clearing demonstrations. The University itself organized a demonstration crew and obtained the co-operation of three railroads operating in the State to run trains over their roads with a view of showing the settlers how to clear their land.

The Du Pont Company participated in the demonstration, showing how to clear land by blasting the stumps with dynamite. Several manufacturers of stump pullers had their demonstrators show their methods of clearing. Up to that time, the powder manufacturers and the stump puller men had regarded themselves as bitter competitors. The University's demonstrations, however, proved that they were really co-operators, for the fact was developed that the best method of land clearing was a combination method in which dynamite was used to loosen and break up stumps after or before the pullers pulled them.

The State Legislature of Wisconsin, its interest aroused by the University's demonstrations, recently passed a law making it easier for settlers and owners of stump land in Wisconsin to buy dynamite or stump pulling equipment with which to clear. Under certain conditions, the State will place orders for dynamite, usually purchased in carload lots in order to get the lowest price, and permit the settlers to pay the State Treasurer in easy installments and under conditions which they can easily meet for the dynamite they use.



The Shaded Areas Show the Amount of Developed Land in Each of the Counties of Wisconsin, a State Where Much Energy is Being Expended in Land Clearing

Actuated partially by the same motives, the Congress of the United States enacted laws under which the new Land Banks were organized in many localities, and these banks also make it easy for farmers to obtain funds with which to clear and otherwise improve their farms and operate them more extensively.

The farmer no less than the soldier is fighting the battle of freedom. Without farm products, the soldier would be as helpless as the engine without steam or fuel.

Probably no more favorable opportunity to clear stump land will ever present itself to the owner of such land. The unprecedented demand for abnormal quantities of food products at abnormally high and profitable prices offers the chance to get the money for land clearing that will probably never come again.

Even the fuel shortage helps land clearing, for in some cases it is now possible to sell stump wood for as much as the clearing costs.

The Gentleman Farmer and Food Production

PRACTICALLY every suburbanite and others who have small areas of but partially developed garden lands on their premises have long entertained dreams of seeing these lands developed into flourishing plats yielding necessary crops, but have lacked the incentive to make a start. At no time in the history of America has the demand for such gardens been greater, and, now that there is the element of patriotism added to the earlier dream, there is little doubt but that 1918 will mark a decided improvement over the good work of 1917 in home-grown foodstuffs by these men who have both the financial means and the idle land.

Actual plans are being formulated and frequent reports are received of work already undertaken.

In one case a man of comfortable means has already bought two milch cows, not because he feels that he can derive a profit from them, but because he realizes that the closing out of dairies in his vicinity will create a shortage in dairy products.

A wealthy business man owning an estate of but a few acres devoted all suitable land to growing potatoes last year, and allowed his men who maintained their own homes sufficient time to cultivate gardens that yielded well. He will continue this arrangement.

Even the flower beds and borders that have been so generously fertilized and watered for years are being devoted to the growing of light truck crops, especially those maturing early. Many of these vegetable beds, if properly cared for, will be almost as attractive as the flowering plants formerly grown, and will have far more personal interest.

There is now an excellent opportunity for those who can to assist materially in increasing food production.

Free Game Law Summary

There has been issued by the United States Department of Agriculture a summary of the provisions of the Federal, State and Provincial laws, as they apply to our game. This booklet is the most complete pamphlet of this character that has ever come to our attention. It is for free distribution, and may be obtained by application to the Division of Publications, United States Department of Agriculture.

Everyone interested in American game birds or animals should write for a copy of this booklet.

Federal Explosives Regulations

FOR the benefit of those purchasing or using explosives and explosive ingredients, the following letter has been sent out by the Du Pont Company.

DEAR SIR:—

For your information and guidance we beg to quote instructions issued by the Bureau of Mines, Washington, D. C., under Federal Explosives Act—Public No. 68—65th Congress—H. R. 3932, governing Explosives.

"*CERTIFIED COPY FILED WITH MANUFACTURER*

"*Every manufacturer, dealer or other person selling explosives shall, if the purchaser appear in person, require the presentation of the license under which the purchase is made; or, if the order is received by mail, telegraph, etc., he shall require A CERTIFIED COPY of the purchaser's license to be on file in his office. Provided, that if sales are made through traveling salesman, and the purchaser presents his license to such salesman at the time of the placing of the order, it will not then be necessary for him to have a CERTIFIED COPY on file with the vendor. Such salesman must, however, in forwarding the order to his employer, state that a proper license has been presented to him and give its class and number upon the order.*

"*NUMBER OF LICENSE SHOWN ON BILL OF LADING*

"*Before making delivery of any less than carload shipment of explosives and ingredients to a carrier, the vendor must plainly stamp or MARK THE NUMBER OF THE CONSIGNEE'S LICENSE on the bill of lading and shipping order, or on whatever other receipt may be given by the carrier as follows:*

"*UNITED STATES EXPLOSIVES LICENSE NO. ——*

CERTIFIED COPY FILED WITH RAILROAD AGENT

"*The agent of any carrier at the final destination of any such shipment, before making delivery to consignee, shall require the consignee to file with him a certified copy or to exhibit the original license or CERTIFIED COPY thereof, authorizing such consignee to purchase, accept or receive such explosives, and such license must correspond with the waybill as to name and number of license. When such shipments are made to non-agency points, delivery may be made to consignees, known to the train conductor upon presentation to him of the license or CERTIFIED COPY corresponding with the waybill as to name and number.*

"*Teamsters or other persons hauling explosives from delivery stations must be properly authorized by the licensee to accept and haul such material.*

"*MANUFACTURERS OF EXPLOSIVES*

"*Every branch office and shipping magazine should be furnished with a CERTIFIED COPY of such licenses as are necessary for the business therein transacted.*

"*No order shall be accepted unless the purchaser produces the license or has a CERTIFIED COPY on file with the vendor, excepting as provided for in rules covering shipment of explosives, etc.*

"*VENDOR OF EXPLOSIVES*

"*Vendors must require every customer making purchases of explosives in person to produce his license and must satisfy themselves as to such customer being the legal owner of the license presented, and must have on file CERTIFIED COPIES of the licenses of such customers as order by mail, telegraph, etc.*

"*In shipping explosives to their customers by common carriers, vendors must show the purchaser's license number on the bill of lading and other shipping papers.*"

From the foregoing Regulations it will be observed:

1. Persons purchasing explosives in person are required to present their license to the manufacturer or vendor with every purchase, and to present such license or file certified copy with the Railroad Agent at destination before they can receive explosives.

2. Persons ordering explosives by mail, telegraph or telephone, must file a certified copy of their license with the manufacturer or vendor from whom purchase is to be made and present the original license or file a certified copy with the Railroad Agent at destination to receive explosives.

3. Persons ordering explosives through traveling salesman must present their license to the salesman. The salesman should state on his order that a proper license has been presented with its class and number.

To All Purchasers of Explosives

We recommend you immediately obtain CERTIFIED COPIES of your license (from the local licensing agent who issued your original license). File one certified copy with our Branch Office from whom you purchase and a Certified Copy with the Railroad Agent where explosives are received.

Companies or persons using explosives in more than one state should obtain a license in each state explosives are to be used and file Certified Copies as above advised.

All sellers of explosives are required to keep a record of sales. A book of standard forms for keeping such record has been prepared by this company and is furnished free on application.

Blasting Ice

Now is the time to be on guard to prevent damage from ice gorges in streams. The best way to eliminate the danger is to practically honeycomb or break up the ice with dynamite at or about the point where the gorge usually or seems likely to occur. By so weakening the ice, it gives easily when the "rush" comes.

Holes about 10 inches in diameter, 30 feet apart across the stream, and 60 feet between rows should be dug through the ice. Into each hole from 5 to 10 cartridges of dynamite tied securely in a bundle should be loaded and primed with an electric detonator. Dynamite should be allowed to float just under the ice, and bundle tied to a stick laid across the hole to prevent being lost.

It is best to fire several holes at a time electrically, but caps and fuse can be used if electric firing is not possible.

If gorge has actually formed, honeycomb in below it as above described. Place a heavy charge at center or weakest points under the ice if possible, and fire. To break large gorges may require anywhere from 100 lbs. to 2000 lbs., according to size.

Raise a Pig

THIS year everyone who has a bit of land should raise a pig—as many more as posssible. On every farm, large and small, on the small suburban estate, even in the city backyard, there is room to raise enough pigs, in the aggregate, to entirely put an end to the present pork shortage, which, according to government reports, is rapidly increasing.

As a rule, a pig can be raised on what is thrown away by the average family, together with what it can grub for itself. It amounts then to converting waste material into valuable food products, at practically no outlay for labor and, on the basis of present pork prices, at a very considerable profit.

Now is no time for being over-finicky. A pig, properly raised, is no more objectionable than a cat. One is a producer—a direct assistance in winning the war; the other is a parasite that serves no useful purpose whatever. We are limiting our industries to essentials. Why not apply the same rule to our domestic economics?

Many towns and cities have already suspended ordinances prohibiting the keeping of pigs. All others should do likewise. Our duty to the nation is clear.

On farms hog production can, and must, be greatly increased. When labor conditions prevent the raising of crops requiring a large amount of hand labor, hog raising fits in admirably. The same applies to land that is partially cleared. Much of the feed can be furnished by easily grown pasture crops that can be harvested by the hogs themselves.

At the present time, thousands of immature hogs are being marketed every day. At the same time we have a great surplus of soft corn, which is good only for feed purposes. Both represent a great economic loss to the nation and a considerable financial loss to the farmer. By keeping the immature hogs on the farm and feeding them on soft corn, they would soon develop into standard animals and bring very satisfactory market prices, with profit to the farmer and a substantial increase in the country's pork production.

The 1917 corn crop exceeded that of 1916 by 500,000,000 bushels. Even making allowances for the corn that will be used for flour to make up the wheat shortage, there is an increase of over 950,000,000 bushels of cereals of all kinds available for feed over 1916. This tremendous surplus ensures an adequate supply of feed and also reasonable prices for those who must purchase grain.

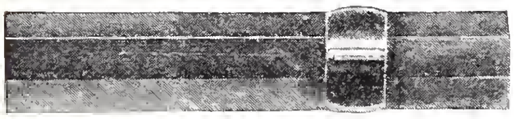
If we do not take energetic steps to increase our pork production, we will have a still more acute shortage of pork products, and even higher prices for hams, bacon, and lard will prevail.

We have the remedy in our own hands—Raise a Pig!

Sights and Sighting

THERE have been great advances in the kind of sights used on sporting and military rifles, from the old style arquebuse fired at point blank range to the modern high power rifle effective at a mile or more.

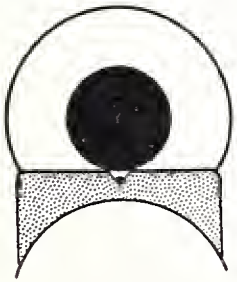
The old muskets and rifles were minus any sights at all, or at the best a very crude knob on the front end of the barrel served as a front sight. A rear sight was an unnecessary ornament, for the range of the guns was so short that all shooting had to be done at point blank distances. As firearms were improved and better powder was developed, the effective range was increased to such an extent that the crude sights had to be greatly changed and made more accurate.



A Modern Ivory Bead Front Sight

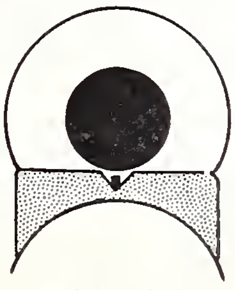
From the fixed, coarse, round knob of a front sight has been evolved the movable knife blade and bead sight tipped with ivory, gold or other material to assist the eyesight of the shooter. Also, from an entire absence of any rear sight at all, there has been developed through the various stages of a crude open notch cut in a raised place on the breech of the barrel, the present refined movable V notch sight with adjustments for elevation and windage. The rear peep sight is another sight development, but the most refined for long range accurate shooting is the delicate telescopic rifle sight.

Human muscles, nerves and eyesight are not so mechanical in their actions as a finely finished machine, and are more subject to variations and inaccuracies. To overcome this, and to act as an aid to the human senses, are the chief aims of sight-makers. After all, the only purpose of sights is to enable the shooter to point the rifle so that the bullet will hit the target.

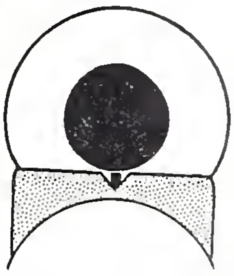


A Fine Sight

However, the differences in the eyesight and nervous and muscular action and reaction of different individuals, which may be called the "human equation," will cause different final results to be obtained from even the most finely adjusted scientific instrument. This is equally true in the use of the rifle, for different persons will get a different grouping or arrangement of bullets about the target when shooting the same rifle under identical conditions. Again, each shooter may have certain peculiar personal characteristics that may result in the majority of his bullets going to one side of the bull's-eye, even though the sights and other mechanical features of the rifle itself be perfectly co-ordinated.



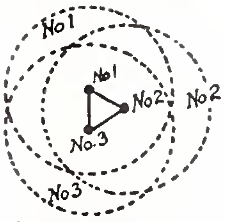
A Coarse Sight



A Full Sight

The first difficulty encountered by the marksman lies in the peculiarities of the human eye. The muscles of the eye unconsciously change the distance of the lense from the retina so that the image of whatever is being looked at is automatically focused upon the retina. This gives clear, sharp and distinct images of the object viewed, but other objects in the line of vision or sight that are nearer or farther away from the eye are slightly blurred or fuzzy in outline, because they are out of focus.

For training the eye and accustoming the muscles to focus so that the least blurring occurs, the method called "triangle of sight" is of excellent service. A loosely filled sand bag is placed on top of a tripod, and the whole is adjusted so that when the rifle is laid across the bag and bedded down so as to remain firm, it is at the proper height for aiming from the shoulder without disturbing or moving the rifle. This is set up about thirty feet away from a wall, and a blank sheet of paper is attached to the wall in a line with the sights. Then a small black circular disc with a pin hole through the center is attached to the end of a slim pointer. The sighter takes an aiming position at the tripod without disturbing the rifle, while an assistant moves the disc over the paper on the wall at command until in the opinion of the sighter it is exactly in the line of sight for a bull's-eye shot. A pencil dot is then made on the paper through the center pin hole in the disc. The disc is then moved, and the sighter steps away from the rifle for a few seconds' rest. The operation is repeated until three points have been made on the paper. Generally these points will coincide fairly closely, but can be connected by lines forming a triangle. The size of the triangle is an indication of the accuracy of the sighting being done, for the larger the triangle, the poorer and more erratic is the sighting. Practice in this manner will train the eye and correct differences due to plain errors in sighting.

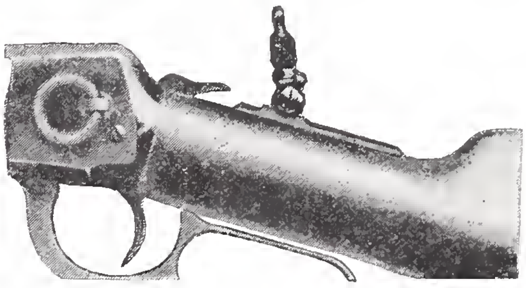


The Triangle of Sight Diagram

In this connection there are three general methods of taking sights with the standard open or V sights, and the marksman should select the one which gives the best results for his particular eyesight. One, called the fine sight, consists in taking just the bare tip or minimum amount of the front sight that can be seen through the bottom of the notch in the rear sight. In poor light, the amount of the front sight showing above the rear notch must be increased, which results in what would be called a coarse sight in a good light. However, the use of a coarse sight for all types of shooting will result in somewhat erratic sighting on account of there being no mark to show just how much of the front sight shows. The full sight means taking enough of the front sight to fill or come level with the top of the V notch.

Rifle Mounted With Tang Peep Sight

The above applies more particularly to the knife blade front sight with no bead on the top, and the plain straight bar rear sight with V notch in the top of the bar. Where a round bead front sight is used, the rear sight notch is usually of the rounded bottom U form, and the methods of sighting are, according to the amount of front bead showing above the bottom of the notch, a fine bead, a coarse or half bead, and full bead.

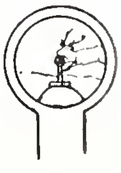


A Modern Peep Sight on Rifle

Whichever method is selected, it should be adhered to, for a change will cause the hits to be either above or below the bull's-eye.

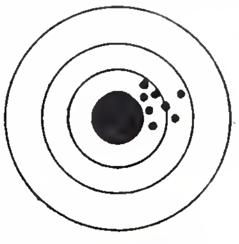
In correcting the sights of the rifle to suit individual characteristics, a steady support should be secured over which the rifle can be rested. A sand bag makes an excellent rest, and the firing can be done either from a lying or sitting posture, where rests can also be obtained for the body and arms of the shooter. The target should be about fifty yards away, and the same kind of ammunition should be used as is going to be used in future shooting.

Several shots should be fired, each with equal care, and their grouping observed with respect to the bull's-eye. If a majority of the hits are low, the rear sight notch piece should be raised slightly in the sight



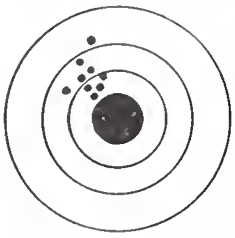
As Seen Through a Peep Sight

frame, which can usually be done without changing the rear sight elevating mechanism for firing at longer ranges. If the hits are high, the notch should be lowered. Should the hits be to the right of the bull's-eye, the front sight should be moved slightly to the right, or the rear sight to the left, in its slot in the rifle barrel. Where the group of hits lies to the left of the bull's-eye, the correction should be made by moving the front sight a little to the left, or the rear sight to the right. When there is a considerable side adjustment to make, part of it should be made on the rear sight, and the rest taken up on the front sight.


A Group of Hits at Right of Target

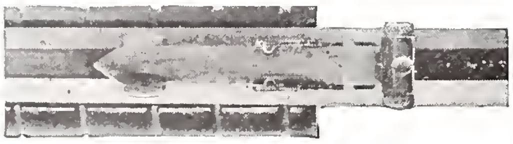
Barrel sights are nearly always put in from the right-hand side of the rifle barrel, hence if for any reason it is desired to take a sight out of its slot, it should be driven from the left to the right.

By the firing of a number of groups of shots, with the sight correction made for each group, the shooter will be able to fit the rifle to his peculiar individual characteristics. This will result in much better scores being made at the target range, and a larger number of hits registered on wild game.


Group of Hits Above and to Left of Bull's-eye

There are various kinds and sizes of notches for open rear sights, varying from the wide-angled coarse open V, which is mostly used for quick snap shooting at running game in a wooded country, to the fine notch in a straight bar for target and long-range work. Each is adapted to its particular field and finds many adherents, for every marksman has his own preference for sights that produce the best results under his handling.

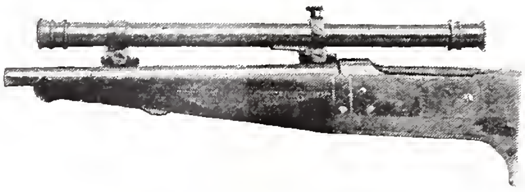
The best modern rear sights have adjustments which move the rear sight to either the left or right to make allowances for windage. At short ranges, the effect of a cross wind in blowing the bullet from its course is not important, but at the long ranges it becomes quite an item, and must be taken into consideration. If the wind is from the right, the rear sight must be moved to the right and vice versa. The amount of offset to allow upon the graduated windage scale depends upon the range, the velocity of, and direction of, the wind. This can be determined only by actual practice, and then depends to a large extent upon the judgment of the shooter.


Open Rear Sight With Windage Screws

Peep sights are generally placed over the breech or on the tang of the rifle back of the breech. They have a small hole through which the eye looks instead of a notch, and increase very much the field of vision. A bead front sight is of better use with a peep sight than a knife blade. Nearly all of the peep sights are screwed solidly to the rifle, and do not permit of being moved sideways, hence sight corrections either to left or right are made on the front sight. They are, however, equipped for range elevation and for windage adjustment.

A Gun Mounted With Open V Sights

The size of the peep hole has a considerable effect on the accuracy of the shooting. A large hole is used for quick snap shooting in hunting, while a very small hole through a large disc is used for fine target work and long-range shooting.


A Delicate Telescope Sight

Telescopic sights may be considered as the ultra-refinement of all rifle shooting. They are quite expensive and are only adapted to long-range shooting, or extremely fine work on the target range. For ordinary shooting in the hunting field, telescopic sights are too cumbersome and too slow, for most game shooting is too much of a snapshot nature for the use of these sights.

Modern Rifle Equipped With Telescope Sights

Nearly any rifle can be fitted with the telescope for fine target work, and the sights removed when the gun is wanted for hunting purposes. The magnification varies from three to five powers in the standard sights on the market, the higher powers being used for long range shooting. The telescope sits high enough above the barrel so as not to interfere with the regular front sight, which is not necessary when using the telescope. Inside the tube are cross hairs or an aperture, whichever is preferable to center on the target. Windage and range adjustments are also provided.

By a proper adjustment of sights to suit the individual characteristics of the shooter and the devotion of some time in conscientious practice, the average rifle owner can develop into the sharpshooter class, which is the goal of all lovers of rifle shooting.

Saving Starch

MANY people take life, and the things pertaining to it, as a matter of course. Few are they who use their leisure moments to learn the "why" for this thing or that. As an example, note an every-day article. How old is the detachable starched linen collar? No doubt, there will be various answers. The right one is ninety-two years. The detached white starched collar of today was invented about 1825, by the wife of a blacksmith of Troy, New York. She cut the first one out with her scissors, and made it, with a shirt to match, and her husband wore it. It did so well that she made some more, and gradually the industry grew.

This brings up another question—When was laundry starch first used? This answer is, away back in the time of Queen Elizabeth, when men and women wore great linen ruffs around their necks, and the fabric had to be stiffened to hold its shape. The Puritans of England denounced ruffs as "devil's finery," and they cursed starch as a "devilish liquor." Even this cursing did not stop the linen collar from becoming popular, and now there is hardly a man who does not wear daily, or at least weekly, a starched collar. We really should have said "who has not worn a starched collar," for many men at the present time are wearing non-starchable collars, because the Great War has changed conditions and circumstances in many lines. Conservation and economy are counted as words of victory, and foods will help. Millions of bushels of potatoes and corn are used every year to make thousands of tons of laundry starch. Think how many people could be given nourishment by that amount of food.

Men who are helping to win the war, even though not in a trench, have come forward with this question, "Why not use the starch that is necessary to keep linen collars in shape for food purposes?" The result has been the adoption, by many men, of the cleanable collar—not the old-time affair known as a "shiner," but a collar that resembles linen collars too closely to be detected.

High-grade cleanable collars look exactly like ordinary collars, have the same up-to-date styles, and the same color. They are made of collar fabric, but the surface is treated to make them instantly cleanable with a sponge or damp cloth. Motorists find them very convenient while on tour. They are being worn not only by substantial citizens who desire to help conserve the corn and potato crops, as well as cut out laundry bills, but by fastidious dressers as well.

Under present conditions it looks as if the cleanable collar was just starting its career. Conservation of starch; muslin; and money. All are in favor of it.

The Honor Roll

3070 Strong

Following is a list of employees of Du Pont American Industries who have entered the Army and Navy in the defense of Democracy. 2966 names have already been reported; this list includes 130 names; there have been 26 duplications and rejections, leaving a total of 3070. The Du Pont Company and their fellow-employees are glad to honor them. On their return to civil life, after their duties as soldiers have been performed, a hearty welcome will await them, and every effort will be made to place them in as good or better positions than they have left.

"Over the top with the best of luck—and give them Hell."

SALARY ROLL

Hopewell

GUN COTTON PLANT

Allen, Porter W.
Cooke, Harvey D.
Gill, George R.
Holt, Robert B.

Telegraph & Telephone

Sullivan, Daniel

Paymaster's Division

Booth, Henry A.

Repauno

HIGH EXPLOSIVES PLANT

Huger, Joseph P.

Engineering Department

Connollee, Alfred C.
Stewart, Herbert H.
Tilden, Van A.
Wright, Ellwood

Chemical Department

Crockett, Wm. G.
Hutton, Ulric O.
Perkins, Granville A.
Reed, Chas. S.

Arlington Works

PY-RA-LIN

Cobb, Fred L.
Daley, V. L.
Friars, Wm.

Harrison Works

PAINTS AND CHEMICALS

Wilson, B. A.

Carney's Point

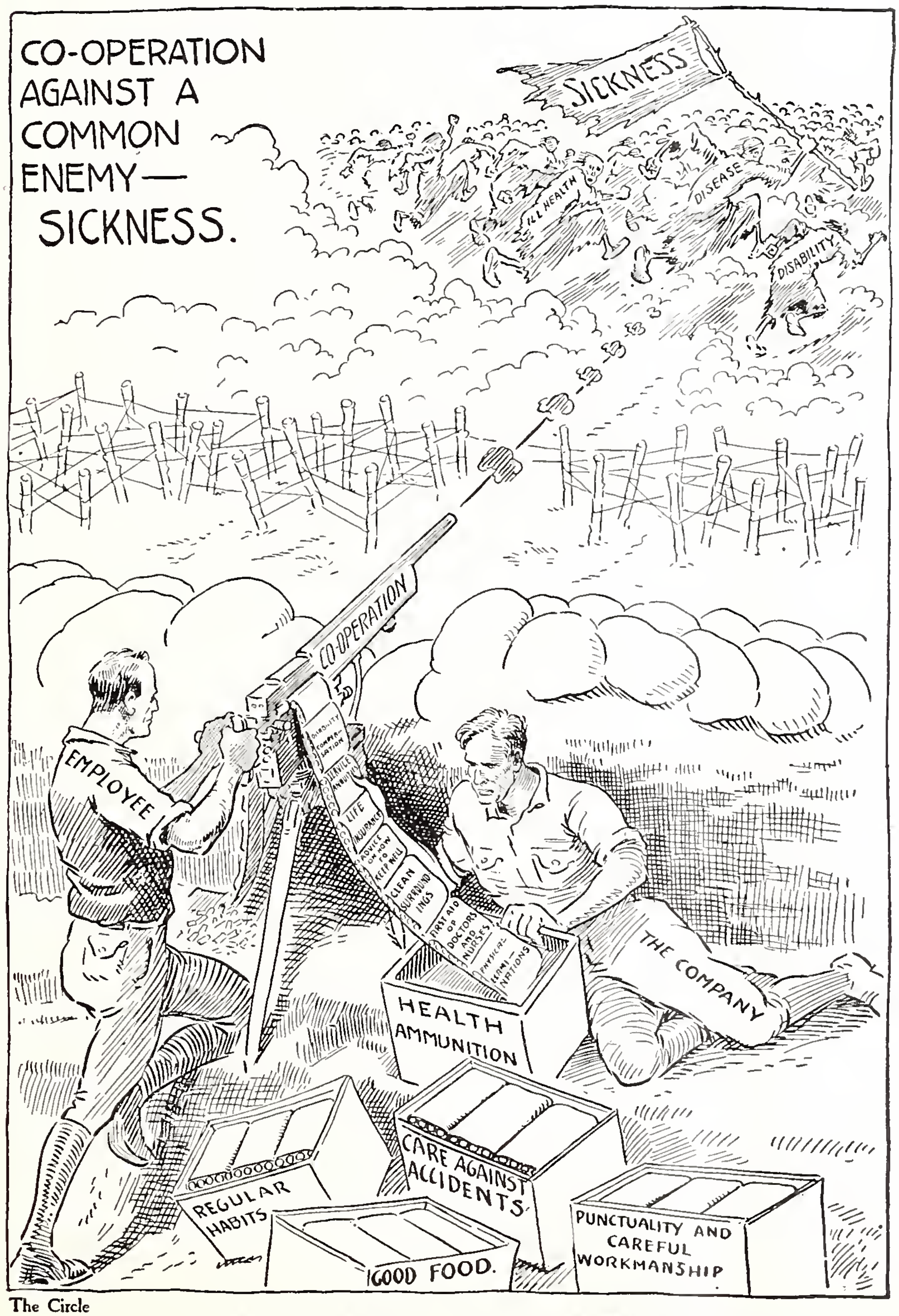
SMOKELESS POWDER PLANT

Coates, E. Osborne
Dodson, Brooke

Haskell Guard

SMOKELESS POWDER PLANT

Griggs, Earl E.



The Circle

During the War Defense Against Disease is as Imperative as Against the Armed Forces

PAY ROLL

Hopewell

GUN COTTON PLANT

Benson, Martin L.
Blackwell, Joshua
Blyth, James
Bonner, Ember
Bowen, Melton
Bower, Albert
Bowman, John
Brown, Will
Boulware, Bunion
Clay, Earl
Condelis, Steve
Conklin, Roscoe
Cooper, William
Davis, Joseph
Eddie, Robert
Edwards, Michael
Elliott, Loss
Ellison, Quinne
Felder, David
Fry, Charlie
Garo, Mike
Groce, Frank
Hawks, Goody
Hawks, Lee
Howard, John L.
Howard, Joseph
Jones, George
Jordan, James B.
Kemp, John R.
Ketchen, William
Mills, Lacy
Morris, James H.
Nyche, George
Parker, James
Patterson, James
Powell, John
Queen, James
Rawles, William
Singleton, George
Singleton, Simuel
Spivey, William
Starling, Troy
Stocks, John
Taylor, George
Taylor, Johnnie
Taylor, William
Tucker, William
Tuggle, Sam
Walker, Bennie
Warner, Walter
Webb, James
West, Carl
Whotener, James L.
Williams, Clarence
Williams, Clarence
Wiltshire, George
Wyatt, Johnnie

Fairfield

Feeney, James
Frederickson, Albert
Rockwell, Wm. A.

Shilzewick, George
Stosoin, Constance
Tronranowisky, John
Tyler, Rodney

Brandywine Shops

MACHINE

Gordon, Thomas
Hainnes, Beni
Kelly, Frank J.
Maloney, Samuel
O'Neill, Paul A.

Repauno

HIGH EXPLOSIVE PLANT

Havens, Samuel J.
Munyan, Clinton R.

Carney's Point

SMOKELESS POWDER PLANT

Allen, Frank G.
Bertolett, Edwin
Caluppett, J.
Canary, Clarence E.
Carlbert, Philip
Cavanaugh, F. W.
Collins, John
Eckstine, John R.
Fox, John
Franz, Herbert
Greshuk, John
Hammer, H.
Hanan, James
Hernes, Harry J.
Herdman, Arthur
Jackson, Wilbert
Keene, Patrick
Kelly, Harry J.
Kenney, Edward F.
Love, Calvers B.
Roberts, Emmett
Rouck, Clarence V.
Schatz, Oliver
Sesco, William
Sibley, Clarence C.
Smith, Eugene
Starkey, Jacob
Sullivan, Alfred F.
Wilson, Fred
Wilson, George
Yoano, Alfonso
Zoffer, Henry
Zolwarsky, M.

Du Pont

HIGH EXPLOSIVE PLANT

Natucci, Ray
Ponton, William R.
Stafford, Robert

Harrison Works

PAINTS AND CHEMICALS

Rafferty, Peter

Corrected to Record of February 8, 1918.

From One of the Boys

GENTLEMEN:—To-day, on arriving home on a furlough, I was agreeably surprised to find a copy of your splendid magazine and to find my name on the Honor Roll of Carney's Point plant. It did me good and cheered me up to know that my fellow workers and employers are thinking of the boys who went.

I am still on this side, but am busy doing my bit. I have met but one of the boys and he had been away too long to have any news from the plant.

An item of importance is that I married the day after my enlistment in the navy.

Hoping to see more of the roll, I am, as ever,

Yours truly,
LEMUEL B. MILLER, JR.

Game Sanctuaries and Conservation

Dr. Joseph Kalbfus, Secretary Game Commission of Pennsylvania

I BELIEVE I have the unqualified endorsement of every member of the Game Commission of Pennsylvania in the declaration that we are protecting and trying to increase game—both animals and birds—so that they may be killed by sportsmen, to the greatest number possible, considering the future of the species, and not simply to be looked at or photographed.

To secure an increase in game, we believe that the future of many kinds of game in this State depends upon the enactment and strict enforcement of drastic laws, because we are in touch with existing conditions, and know the need for immediate energetic action if our game birds are to be perpetuated, much less increased.

We realize the many and varied benefits that come through hunting, and are doing our best to advance the interest of sportsmen we represent. We hold that hunting is a national necessity, not simply recreation or a waste of time. We believe that the presence of game in any State according to its quantity and variety is an asset greatly to be prized.

The presence of game is an incentive to outdoor exercise that means better health, and, therefore, better citizenship for many. The man who hunts acquires a knowledge of the territory covered, of the flora, of the fauna, of the waters, of the minerals, of the general topography and of the people, that can be acquired to the same extent in no other way. We further believe that the ability of the hunter to traverse the woods, the fields, or the waters of this State, either by day or by night, to camp and to shoot straight, make him with limited discipline and drill the equal of any regular on the face of the earth!

Furthermore, not only does the quantity of game taken constitute a very considerable portion of the meat supply in various homes, but the value of the life-work of birds protected continuously is an aid to the farmer and the fruit grower that makes the profitable growing of his crops possible.

In this State every cent used for the protection of game and wild birds, for the payment of bounties, for the purchase and releasing of game for propagating purposes, for the creation of game sanctuaries, for the feeding of game during the winter-time, as well as for all other needs of the Game Commission, comes from sportsmen through the resident hunters' license. Even the farmer, who derives the most benefit from the work of birds, does not contribute one cent to their benefit unless he goes hunting on lands other than the lands he resides upon and cultivates or lands adjacent, for our law permits a farmer and his family to hunt on these lands without a license.

We know what sportsmen are doing, and in turn we are striving to do all in our power to benefit these men through the increase of game to be killed. Just how we can best secure that increase is the question.

In this State, after years of careful consideration, we have concluded that wild turkeys, ruffed grouse, quail and woodcock, and certain animals, could not be successfully reared in captivity—at least not in numbers or at reasonable expense. About twelve years ago we, therefore, turned to the idea of a public game sanctuary, or City of Refuge, and I will devote this article to that subject, believing from experience that such a sanctuary is the true solution of our problem.

Cities of Refuge

Under the laws of this State we have authority to create game preserves or sanctuaries either on lands owned by the State, or on privately owned lands through lease.

The lands designed for such purpose are selected considering the food supply, the water supply, and the topography of the land. We know that the snows of winter usually disappear first on the steep hillsides of a southern exposure, upon which our game animals that graze may find grass, and our birds the gravel and sand necessary to their well being. Large evergreen timber and deep ravines are

Liberating Elk to Restock the Sanctuaries found beneficial because of the shelter they afford from cold and storm.

Our preserves are laid out considering the possibility of travel around them, and are of no fixed form. As they are now created, they are each one about nine miles in circumference, and inclose about five square miles, or 3,200 acres. We consider a tract of this size large enough for the purpose intended—that of providing safety and food and peace and rest to game creatures that may retreat to its confines—and not too large, as are some of our national preserves, to permit animals to breed and live and die in them without benefiting any one.

Our preserves are surrounded by an open space from ten to fifteen feet in width, from which the underbrush has been cut. This is known as a fire-line, because over this line we travel to meet and extinguish occasional forest fires. On the inner side of this fire-line is stretched, about waist high, a strand of wire as thick as a telegraph wire, to mark the boundaries of this fixed area, and to give notice that it is more than an ordinary tract of land.

Along the wire at intervals of a hundred yards or so we have posted notices printed on cloth, calling attention to the fact that the wire encloses a state game preserve, upon which no hunting by any person is permitted at any time, and asking those who read to keep out and help us to keep others out. Game is not enclosed, but comes and goes at pleasure. No dog is permitted on these lands at any time.

Each preserve is under the supervision of a keeper, who lives in a house erected for his use. He has a stable, a horse, and suitable fire apparatus. During the open season he travels around the sanctuary at least once each day. During the closed season he goes around as necessity may require.

It is the duty of this keeper to protect and feed game in the preserve, to kill vermin, and to see to it that any animal mortally wounded by hunters during the open season is captured and delivered to the men who first wounded the animal. The hunter, following his wounded quarry, finding it has gone under the wire, immediately reports that fact to the keeper, who, if he find the game mortally hurt, kills it and delivers it to the hunter to whom it belongs.

Exterminating Vermin

In the killing of vermin—wild cats, foxes, weasels, mink, hawks, owls and crows—we use guns, traps and poison, as we have found all three necessary to our work. We use strychnine because while it will kill any of these vermin or a dog, duck, or blackbird, and many kinds of song and insectivorous birds, it will not kill a chicken, grouse, quail, turkey, pheasant, bear or hog. We have repeatedly fed this poison, in doses sufficient to kill several men, to a common chicken, to quail in captivity and to birds of the grouse and pheasant family, without injury to the birds.

We are informed that in certain parts of Europe, and even in the southern part of our own country, nux vomica, the material from which strychnine is extracted, is mixed with the food of chickens for the purpose of killing hawks. The poison, while not affecting the hen, will kill the hawk that eats the hen. To be doubly sure, however, we use in placing strychnine, a vehicle that neither our game creatures nor wild birds will eat, and one that will not remain on the ground for any considerable length of time.

For foxes and wild cats a sparrow in which a little strychnine has been placed while the bird is yet warm, or a piece of fish or muskrat impregnated with the poison and stuck on a stick or projection of a bush about eight or ten inches from the ground serves the purpose.

For weasels, the body of a rabbit killed by a weasel and saturated with strychnine, dropped into a crevice among rocks, or tied to the end of a stick and stood up in a hollow tree, will prove satisfactory.

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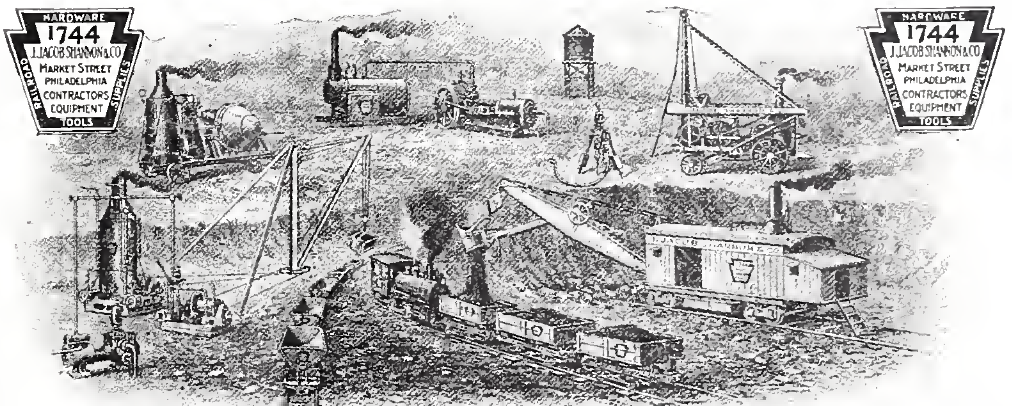

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Explosives Sales Record Book Free

We will mail, free, to any dealer in explosives a book for keeping records of sales of explosives, as required by the Federal law.

The form used will be that approved by the United States Bureau of Mines.

Dealers in dynamite, sporting powder, blasting supplies and blasting powder may get the record book by mailing request to

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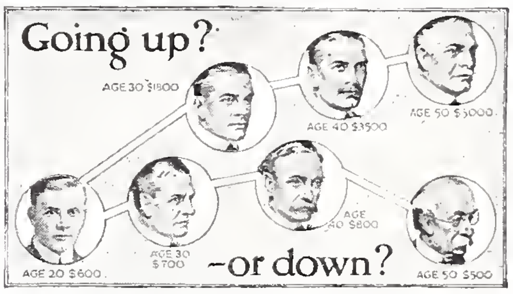
Wilmington, Delaware

OR ANY BRANCH OFFICE:

Birmingham, Buffalo, Chicago, Denver, Duluth, Huntington, Joplin, Kansas City, Mo.; Mexico City, New York, Portland, Ore.; Pittsburgh, Pa.; St. Louis, San Francisco, Seattle, Scranton, Spokane, Springfield, Ill.



HERE is your future charted for you, based on the actual average earnings of trained and untrained men.

Which way will *you* go—*up*, through *training*, to a position that means good money, or *down*, through *lack* of training, into the ranks of the poorly paid? It rests with you. And *now* is the time to decide, not next month, not next year, but *now*.

You can *get* the training that will command a trained man's salary. The International Correspondence Schools have helped hundreds of thousands to qualify for advancement. Let them show you how *you* can prepare yourself, in your own home, for the position you want in the work you like best. Just mark and mail the coupon.

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☐ Poultry
☐ French
☐ German
☐ Italian
☐ SPANISH

*Name*____________________

*Address*____________________

I know of as many as five weasels having been killed by one poisoned rabbit.

A piece of dead horse or cow treated with strychnine, and tied or wired in a tree where crows can find it, means great relief from crows. Crows destroy more small game, birds and birds' eggs than any other creature that lives. A young crow in the nest will consume daily two and three times its own weight of food. When young, the crow is fed chiefly on animal food, mainly the young and eggs of other birds—young rabbits, and anything else of this kind the parent birds can gather.

The robin builds its nest on your window sill or near your home, because he fears the robber crow. Even there the nest is destroyed frequently by crows, and we know that the few occurrences of this kind witnessed are nothing as compared with the many that are unseen. Crows may be of limited benefit to agriculture because of the harmful insects and weed seeds they destroy, but we are satisfied that the birds they destroy, if left alive, would do far more good than the crow. We recommend that crows be destroyed wherever that is possible.

Public Sentiment

While we have at this time a number of preserves in working order in this State, I know of but one man who violated the law relative to such sanctuaries. That man killed a deer inside the wire, and claimed that he had not seen either the fire-line wire or the notice. He paid the penalty—a hundred dollar fine—and we believe it taught him a lesson he will long remember.

When these cities of refuge were first constructed there was much declared opposition to the idea. Many thought the intent was to give special privileges to certain individuals, such men being permitted to hunt inside the wire, where the ordinary man could not hunt. When it became thoroughly understood that this was not so, and that no one, under any condition, could do such a thing, sentiment changed very decidedly.

I now frequently meet men who tell me that they were bitterly opposed to this idea in the beginning, but that now the game sanctuary, as created and managed in this State, has their unqualified support. The feeling now is that our efforts mean more to the cause of game protection and game increase than any other thing ever started in this Commonwealth.

The big antlered deer, as well as the small deer, is safe inside the wire, and both are left to serve the purpose intended by Nature.

A Gamekeeper's Home in the Woods

INVESTMENT REGISTRY OF AMERICA INCORPORATED MORRIS BUILDING, PHILADELPHIA

My Financial Secretary

is the term mentally applied by our members when calling on the resources of Investors' Service.

For we are all that, and more to those who use our facilities for analyzing, purchasing, following up and disposing of securities in a thoroughly systematic and scientific manner. The plan is as logical as the relation between lawyer and client.

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Here assemble each year the best shots of the country,—both amateur and professional.

No resort in the South has a better shooting equipment than

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United North and South Amateur Handicap Target Tournament

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Reservations and tickets from any Seaboard Air Line Agent. Through Pullman from Washington. Write for full particulars.

Pinehurst General Office, Pinehurst, North Carolina

Auxiliary Preserves

In addition to the sanctuary or preserve established on wild lands, our last legislature gave the Game Commission authority to create auxiliary preserves on cultivated lands.

These lands are subject to the same laws controlling the sanctuary proper, except in the matter of acreage. The auxiliary preserves are not, however, under the care of a game protector all the time. They range in size from two hundred and fifty to two thousand acres, and may be located on ordinary farm lands. Upon them quail or turkeys can be reared in an absolutely wild state, to scatter naturally to adjoining lands to the benefit of hunters. They may at any time be trapped by the Game Commission and removed to other sections of the State.

In my next article I will consider Bounty Law, the benefit that may come from such law, and its abuse.

Wall Paper Makers' Answer

We have received from representatives of the wall paper industry the statement that poisonous pigments are no longer used in the manufacture of high-grade paper, as intimated in an article in our January issue.

We wish in fairness to this industry to call attention here to this statement by the wall paper manufacturers.

When Jail Looms Bright

Mr. Younghusband reached home late for dinner.

"I got caught for speeding on the way home," he explained rather sheepishly. "Have to appear to-morrow morning and get 'ten dollars or fifteen days.'"

Mrs. Younghusband fervently clapped two blistered little hands.

"What a providence!" she cried devoutly. "Take the fifteen days, John! The cook has just left!"—*Harper's Magazine.*

Gardening in the South

Farmers' Bulletin, Number 934, "Home Gardening in the South," is just off the press. It contains much valuable advice to the Southern gardener, and may be obtained free from the Division of Publications, United States Department of Agriculture, Washington, D. C.

War Business Demands
Urgently the Best Possible Method of Industrial Management

It is of the utmost importance that you analyze your fuel and power costs, the equipment of your plant, the proper routing of your product and the welfare of the human element.

Knowledge of the facts must increase efficiency and means better business results.

We can assist you in effecting a saving and reducing operating costs.

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INTERNATIONAL MOTOR TRUCKS

Low Cost Hauling

A few years ago some of the biggest, most careful business concerns in this country bought International Motor Trucks, put them to work, and then watched them.

Today those same concerns and many others who saw the tests made are buying

International Motor Trucks

as regularly as additional trucks are needed. Some of them are standardizing their equipment with Internationals—buying nothing else.

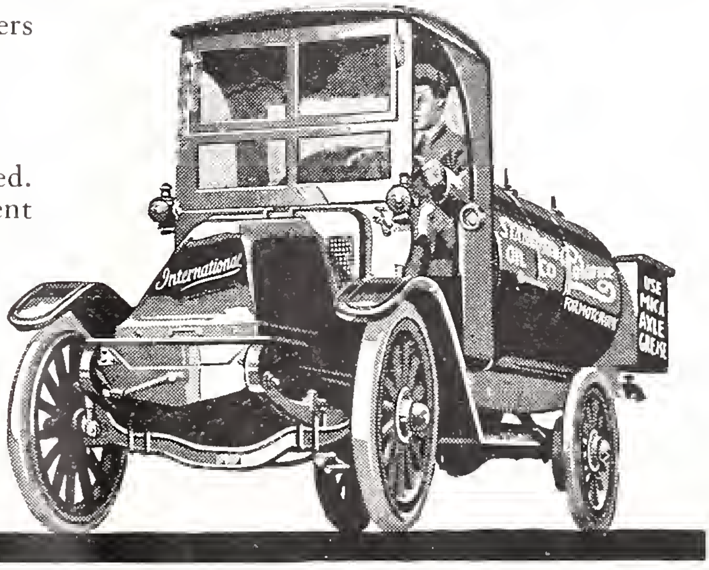
The reason? International Motor Trucks do their work well and at low cost as compared with any other kind of hauling equipment, horse or motor.

Do you want any better reason than that?

Chassis sizes, 1500, 2000, 3000 and 4000 pounds capacity.

Chassis prices, $1450 to $2550, cash f. o. b. factory.

Bodies suitable for every business.



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For the convenience of buyers considering the purchase of any Du Pont product, and desiring specific information, this coupon is printed. Upon receipt, it will be forwarded immediately to the proper office for attention.

Fill in, Cut Out and Mail This Coupon

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- ☐ Charcoal
- ☐ Wood Pulp
- ☐ Saltpetre
- ☐ Refined Nitrate of Soda

PAINTS

- ☐ Town and Country Paint
- ☐ Colors in Oil
- ☐ Vitrolac Varnish
- ☐ Vitrolac Stain Finish
- ☐ Flowkote Enamel
- ☐ Dulite for Mills
- ☐ Antoxide Iron Paint
- ☐ Shingle Stain
- ☐ Auto Finish
- ☐ Sanitary Wall Finish
- ☐ Bridgeport Standard Paint
- ☐ Wheeler's Wood Filler
- ☐ Bridgeport Wood Finishes
- ☐ Smokestack Paint
- ☐ Floor Varnishes
- ☐ Floor Paints
- ☐ Enamels
- ☐ Concrete Paint
- ☐ Marine Paints
- ☐ Industrial Paints
- ☐ Railway Paints
- ☐ Ferro-Keep (Metal Paint)
- ☐ Barn Paint
- ☐ Wagon and Carriage Paint
- ☐ Auto Paints and Enamels
- ☐ Decorative Stains
- ☐ Varnishes
- ☐ Wire Screen Paint
- ☐ Japans
- ☐ Shellac
- ☐ Red Lead

SPORTING POWDERS

- ☐ Hunting
- ☐ Trapshooting
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- ☐ Smokeless Powder
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- ☐ Shooting in Colleges
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CHEMICALS

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- ☐ Pulp Colors
- ☐ Salt Cake
- ☐ Barium Chloride
- ☐ Distilled Water
- ☐ Bronze Powder
- ☐ Bronzing Liquids
- ☐ Wood Lacquer
- ☐ Metal Lacquer
- ☐ Waterproof Cement
- ☐ Py-ra-lin Enamel
- ☐ Pontar
- ☐ Pontoklene
- ☐ Pitch
- ☐ Pegamoid Aluminum Paint
- ☐ Mantle Dips
- ☐ Leather Renovators
- ☐ Ether
- ☐ Parlodion
- ☐ Nitre Cake
- ☐ Creosote
- ☐ Shingle Oil
- ☐ Pyroxylin Solutions
- ☐ Benzol Products
- ☐ Carpo (Metal Paint)

- ☐ Carpolene (Wood Preservative)
- ☐ Wood Oil
- ☐ Dead Oil
- ☐ Belt Cement
- ☐ Household Cement
- ☐ Blanc Fixe
- ☐ Solvents
- ☐ Leather Substitute Solutions
- ☐ Split Leather Solutions
- ☐ Patent Leather Solutions
- ☐ Coke
- ☐ Belt Cement

PY-RA-LIN

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- ☐ Challenge Cleanable Collars
- ☐ Novelty Sheeting
- ☐ Transparent Sheeting
- ☐ Py-ra-lin Rods and Tubes
- ☐ Py-ra-lin Pipe Bits
- ☐ Py-ra-lin Specialties
- ☐ Brushes
- ☐ Mirrors
- ☐ Combs
- ☐ Toilet Sets
- ☐ Manicure Sets
- ☐ Desk Sets
- ☐ Colored Sheeting

COATED TEXTILES

- ☐ Fairfield Rubber Cloth
- ☐ Rayntite Top Material
- ☐ Motor Fabrikoid
- ☐ Craftsman Fabrikoid
- ☐ Truck Special Fabrikoid
- ☐ Marine Special (U. S. Standard)
- ☐ Shoe Special
- ☐ Book-Finish Fabrikoid
- ☐ Fabrikoid Sheeting
- ☐ Home Uses for Fabrikoid
- ☐ Fabrikoid for Baggage
- ☐ Fabrikoid for Upholstering
- ☐ Rug Anchor
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- ☐ Fabrikoid for Railway Cars

Name... Position

Your Address (If Personal)...

Name of Concern (If Company)

Address of Company...

BUSINESS: ☐ Manufacturer; ☐ Producer; ☐ Jobber; ☐ Dealer;
☐ Consumer. (Check which)

What Du Pont products do you sell ?...

If a user, for what purpose does the product checked, or that which you now use, interest you ?...

SPECIFIC QUESTIONS SHOULD BE ASKED IN AN ACCOMPANYING LETTER

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DU PONT AMERICAN INDUSTRIES

The Opportunity
# of the
Hardware Trade

The entrance of the Du Pont Company into the paint field means much more than that we are going to sell paint.

It means the beginning of a new epoch in the paint industry.

The same organizing, operating, selling facilities and abilities that have earned for the Du Pont Company unquestioned world leadership in other fields of industry, are being applied in the paint business.

Just as the dealer who represents Du Pont in the explosives field automatically gets the bulk of that trade in his locality, so will the dealer who represents Du Pont in the paint field automatically get the bulk of the paint trade.

We believe there has been too much tin can and too little annual net profit in the merchandizing of paint.

We propose to sell the protective and decorative features of paints, varnishes and finishes, rather than the cans, and at the same time to make the business show a much larger annual net to our dealers.

We offer to the thousands of hardware dealers now selling Du Pont explosives, the opportunity to join us in establishing a new national paint, varnish and stain service.

We want in every city, town and small town a full line agency for

HARRISONS
TOWN AND COUNTRY PAINT

And another full line agency for

BRIDGEPORT
STANDARD WOOD FINISHES

Each line is complete in itself and on the highest plane of quality and reputation. Each is now backed by the organization and resources of the Du Pont Company.

Act Promptly if You Want This Desirable Connection.

In many towns one or the other or both of these agencies are already established.

In other towns we have numerous dealers in other lines, and we are likely to hear from several from the same city or town.

Except in large cities, we do not want more than one Harrison and one Bridgeport agency.

Prompt action will impress us that you are a live wire and probably the man we want.

Please write, stating which line you prefer, and we will promptly lay our plan before you.

SALES PROMOTION DIVISION

E. I. du Pont de Nemours & Company

Wilmington, Delaware

DU PONT

Keeping Qualities of Smokeless Powder

Twenty-two years ago, Mr. H. L. Haskins, of South Bend, Indiana, purchased at that place some shells loaded with 37 grains Dupont Smokeless Powder and one ounce of shot. On recent trial of these shells, Mr. Haskins broke twenty-two out of twenty-five blue rocks, and Mr. Teeple, who was shooting with him, broke all at which he shot. The loads were quick and snappy, and no difference could be distinguished between them and new loads of the same powder just coming from the factory.

If Each Home Saves

One ounce of meat daily, it means 465,000,000 pounds annually.

And one slice of bread, 365,000,000 loaves annually.

And one piece of butter, 114,000,000 pounds annually.

And one cup of milk, 912,000,000 quarts, or the product of 400,000 cows annually.

What Did Solomon Say?

London children certainly get some quaint views of life. An instance of this recently occurred in an East End Sunday School, where the teacher was talking to her class about Solomon and his wisdom.

"When the Queen of Sheba came and laid jewels and fine raiment before Solomon, what did he say?" she asked presently.

One small girl, who had evidently had experience in such matters, promptly replied:

"'Ow much d'yer want for the lot?"

—*London Opinion.*

The Same Old Hours

She was a widow who was trying to get in touch with her deceased husband

The medium, after a good deal of futile work, said to her:

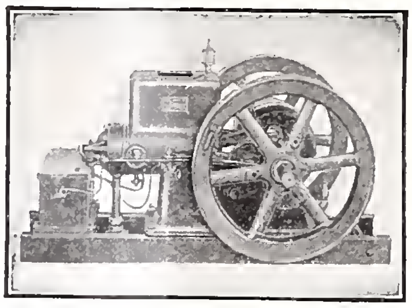
"The conditions this evening seem unfavorable. I can't seem to establish communication with Mr. Smith, ma'am."

"Well, I'm not surprised," said the widow, with a glance at the clock. "It's only half-past eight now, and John never did show up till about three a. m."

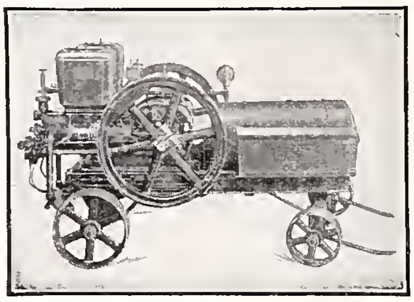
—*Tit-Bits.*

My Tuesdays are meatless,
My Wednesdays are wheatless;
I am getting more eatless each day.
My home it is heatless,
My bed it is sheetless;
They're all sent to the Y. M. C. A.
The barrooms are treatless,
My coffee is sweetless;
Each day I get poorer and wiser;
My stockings are feetless,
My trousers are seatless;
My! How I do hate the Kaiser!

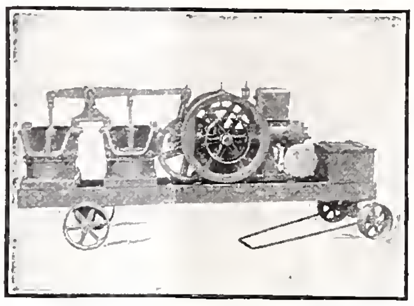
—*Exchange.*



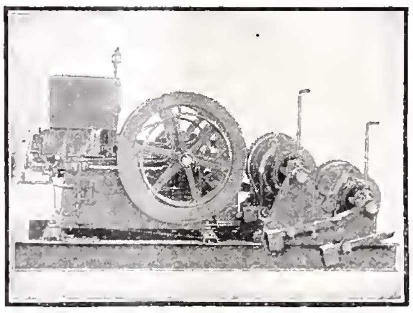
Gas, Gasoline and Oil Engines



Portable Air Compressor



Double Diaphragm Pumps



Double Drum Hoist

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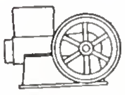
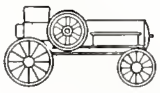
AIR COMPRESSORS, DIAPHRAGM and CENTRIFUGAL PUMPS, DEEP and SHALLOW WELL PUMPS, HOUSE PUMPS, SINGLE and DOUBLE DRUM HOISTS, CONCRETE MIXERS, GAS, GASOLINE and OIL ENGINES

Clip the coupon below, check the machines which interest you, and send for literature, or arrange for trial or demonstration.

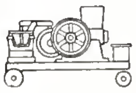
Chris D. Schramm and Son, Inc.
Manufacturers



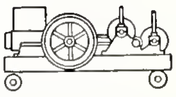
ENGINES



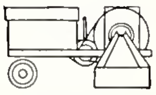
COMPRESSORS



PUMPS



HOISTS



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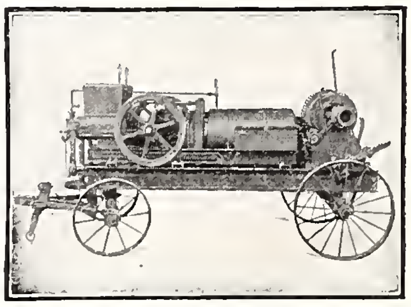

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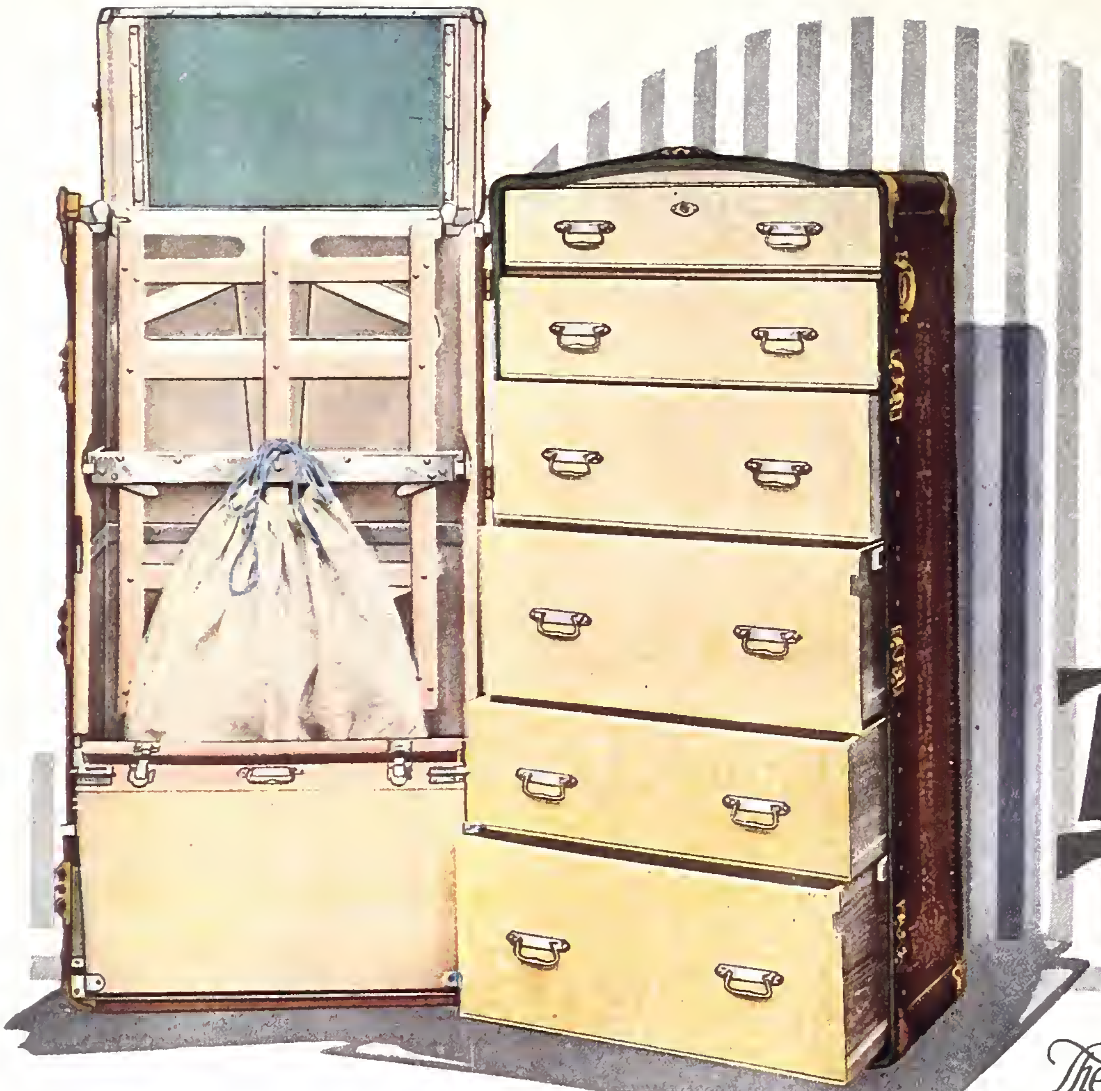

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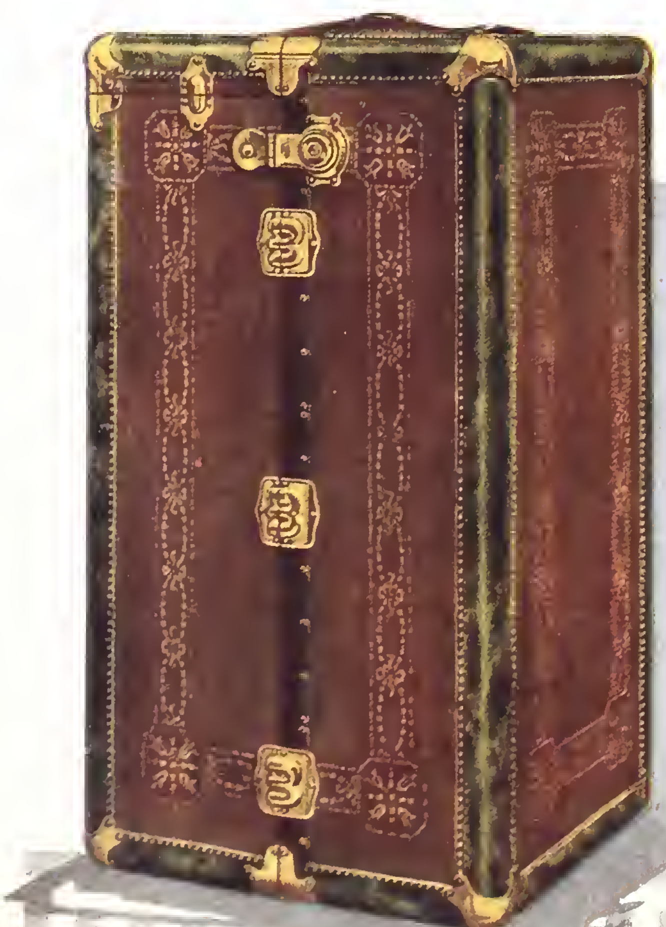

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WAR INFORMATION SERIES No. 20—October, 1918

The GERMAN-BOLSHEVIK CONSPIRACY

ISSUED BY
THE COMMITTEE ON PUBLIC INFORMATION
GEORGE CREEL, Chairman

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The German-Bolshevik Conspiracy

INTRODUCTION

The Committee on Public Information publishes herewith a series of communications between the German Imperial Government and the Russian Bolshevik Government, and between the Bolsheviks themselves, and also the report thereon made to George Creel by Edgar Sisson, the committee's special representative in Russia during the winter of 1917-18. There is also included, in Part II, a report by a committee appointed by the National Board for Historical Service to examine into the genuineness of these documents.

The documents show that the present heads of the Bolshevik Government—Lenin and Trotsky and their associates—are German agents.

They show that the Bolshevik revolution was arranged for by the German Great General Staff, and financed by the German Imperial Bank and other German financial institutions.

They show that the treaty of Brest-Litovsk was a betrayal of the Russian people by the German agents, Lenin and Trotsky; that a German-picked commander was chosen to "defend" Petrograd against the Germans; that German officers have been secretly received by the Bolshevik Government as military advisers, as spies upon the embassies of Russia's allies, as officers in the Russian army, and as directors of the Bolshevik military, foreign, and domestic policy. They show, in short, that the present Bolshevik Government is not a Russian government at all, but a German government acting solely in the interests of Germany and betraying the Russian people, as it betrays Russia's natural allies, for the benefit of the Imperial German Government alone.

Russian Workmen Betrayed

And they show also that the Bolshevik leaders, for the same German Imperial ends, have equally betrayed the working classes of Russia whom they pretend to represent.

The documents are some 70 in number. Many are originals, annotated by Bolshevik officials. The balance of the others are photographs of originals, showing annotations. And they corroborate a third set of typewritten circulars (see Appendix later) of which only two originals are possessed in any form, but all of which fit into the whole pattern of German intrigue and German guilt.

The first document is a photograph of a report made to the Bolshevik leaders by two of their assistants, informing them that, in accordance with their instructions, there had been removed from the archives of the Russian Ministry of Justice, the order of the German Imperial Bank "allowing money to Comrades Lenin, Trotsky, 'and others' for the propaganda of peace in Russia"; and that, at the same time, "all the books" of a bank in Stockholm had been "audited" to conceal the payment of money to Lenin, Trotsky, and their associates, by order of the German Imperial Bank.

This report is indorsed, in Lenin's initials, "V. U." [Vladimir Ulianoff, his real name], for deposit in "the secret department" of the Bolshevik files. And the authenticity of the report is supported by Document No. 2, which is the original of a report sent by a German General Staff representative to the Bolshevik leaders, warning them that he has just arrested an agent who had in his possession the original order of the German Imperial Bank referred to in Document No. 1, and pointing out that evidently "at the proper time steps were not taken to destroy the above-mentioned documents."

Protocol Signed by Leaders

Document No. 3 is the original protocol signed by several Bolshevik leaders and dated November 2, 1917 (Russian calendar), showing that "on instructions of the representatives of the German General Staff in Petrograd" and "with the consent of the Council of People's Commissars," of which Trotsky and Lenin were the heads, two incriminating German circulars had also been "taken from the Department of Counter Espionage of the Petrograd district" and given to the Intelligence Bureau of the German General Staff in Petrograd. On the bottom of the protocol the German adjutant acknowledges receipt of the two incriminating circulars with his cipher signature.

These two circulars apparently had been obtained early in the war by some Russian agent in Germany and transmitted to Russia. The German General Staff evidently wished to get them back in order to remove evidence. By the order of the German General Staff and with the "consent" of Lenin and Trotsky they are turned over to the Germans. Why? Because they fit in with other information of Germany's war plans and preparations before August, 1914. Indeed, several weeks before the assassination of the Austrian Archduke, which was made the pretext for war.

And Lenin and Trotsky surrender them in conformity with a working agreement between the Bolshevik leaders and the German General Staff, of which agreement a photograph is included in the series as Document No. 5.

This is dated October 25, 1917. It is from a division of the German General Staff. It is addressed to the Government of the People's Commissars, of which Lenin and Trotsky were the heads. It begins: "In accordance with the agreement which took place in Kronstadt, in July of the present year, between officials of our General Staff and leaders of the Russian revolutionary army and democracy, Messrs. Lenin and Trotsky, Raskolnikov, and Dybenko, the Russian Division of our General Staff operating in Finland is ordering to Petrograd officers for the disposal of the Intelligence Bureau of the staff." Among the officers named are Maj. Luberts and Lieut. Hartwig, whose cipher signature, Henrich, is given as it appears on the receipt for the two circulars accompanying Document No. 3. And an indorsement on this letter (No. 5) from the German General Staff records that the German officers assigned to Petrograd had appeared "before the military revolutionary committee" and had "agreed on conditions with regard to their mutual activities."

Mutual Activities Shown

What their "mutual activities" were to be is sufficiently indicated by Document No. 7, which is a photograph of a letter signed in cipher by this Maj. Luberts and his adjutant, Lieut. Hartwig. They notify the Bolshevik leaders, on January 12, 1918 (Russian calendar), that "by order of the German General Staff" the German Intelligence Bureau "has reported the names and the characteristics of the main candidates for reëlection" to the Russian Bolshevik "Central Executive Committee," and "the General Staff orders us to insist on the election of the following persons." They add a list of Russian leaders satisfactory to the German General Staff. The list is headed by Trotsky and Lenin. They were elected, and the rest of the present Bolshevik executive committee were chosen from the same German list.

Document No. 8 gives evidence of the *quid pro quo*. It is a photograph of a letter from the representative of the German Imperial Bank to the Bolshevik Commissar of Foreign Affairs. It is marked "Very secret" and dated January 8, 1918. It says: "Notification has today been received by me from Stockholm that 50,000,000 roubles of gold has been transferred to be put at the disposal of the People's Commissars," which is the title of the Bolshevik leaders. "This credit," the letter continues, "has been supplied to the Russian Government in order to cover the cost of the keep of the Red Guards [the Bolshevik revolutionary troops] and agitators in the country. The Imperial Government considers it appropriate to remind the Council of People's Commissars of the necessity of increasing their propaganda in the country, as the antagonistic attitude of the south of Russia and Siberia to the existing Government in Russia is troubling the German Government."

War Materials at Vladivostok

Four days later the same representative of the German Imperial Bank sent another 5,000,000 roubles to the same address to provide for the sending of a Russian revolutionary leader to Vladivostok, to get possession of the "Japanese and American war materials" at that port, and if necessary to destroy them. A photograph of his letter is given as Document No. 9.

There were earlier payments, but probably none later than these. None was necessary. By this time the loot of an empire lay open to the Bolsheviks—and to the Germans.

Most significant of all are two photographs of further communications from the German Imperial Bank, given as Documents Nos. 10 and 11. One is a letter addressed to the Chairman of the Council of People's Commissars, and the other is the "resolution of a conference of representatives of the German commercial banks" received by the Chairman of the Bolshevik Central Executive Committee and indorsed by his secretary. Together they give a complete synopsis of the terms on which Germany intends to have control of all Russian industries.

For five years from the signing of peace, English, French, and American capital in Russia is to be "banished" and "not to be allowed in the following industries: coal, metallurgical, machine building, oil, chemical, and pharmaceutical." These industries are to be developed under the control of a "supreme advisory organ consisting of 10 Russian specialists, 10 from the German industrial organizations and the German and Austrian banks." Germany and Austria are to "enjoy the unlimited privilege of sending into Russia mechanics and qualified workmen." "Other foreign mechanics and workmen . . . are not to be allowed to enter at all" for five years after the conclusion of peace between Russia and Germany. "Private banks in Russia arise only with the consent" of the Union of German and Austrian banks. And so forth.

Conspiracy is Indorsed

And this conspiracy between German Imperial capitalism and the pretended Russian Reds is indorsed by a Bolshevik leader, with the recommendation that it should be "taken under advisement" and "the ground prepared in the Council of the Workmen's and Soldiers' Deputies, in case the Council of People's Commissars will not accept these requests."

Various details of the conspiracy between the Bolshevik leaders and the German General Staff are exposed in documents Nos. 16 to 29. These are photographs of letters which passed between the Bolshevik leaders and the German General Staff, or the German officers in Russia. Document No. 21 shows that on November 1, 1917, when Russia was still regarded as an ally of Great Britain, France, and America, the German General Staff was having "the honor to request" the Bolshevik leaders to inform it "at the earliest possible moment" concerning "the quantity and storage place of the supplies which have been received from America, England, and France, and also the units which are keeping guard over the military stores."

Document 18 shows the German General Staff requiring the Bolshevik leaders to send "agitators to the camps of the Russian prisoners of war in Germany," in order that they might procure spies to work among the English and French troops and to further "peace propaganda." And this is proposed by the German General Staff as being "according to the negotiations between the Russian and German peace delegations at Brest-Litovsk."

In Document 22 the Bolshevik leaders and the Germans are arranging to send "agents-agitators, and agents-destructors" out of Vladivostok "to ports of the United States, Japan, and British colonies in Eastern Asia."

Passports for Germans

In Document 16 Trotsky is providing fraudulent passports for German officers who are going to England, France, and America, as spies and enemy agents. And Document 17 shows Trotsky indorsing a similar proposal: "To be urgently executed. L. T."

Three German submarines are to be sent to the Pacific on the trans-Siberian railway by orders of the German High Command in Document No. 23. Lists of German and Russian spies watching the British, French, and American embassies in Petrograd are given in Document No. 25. And, finally, in Document No. 15 the Bolshevik leaders are warned that information concerning "the connection of the German Government with the Bolshevik workers" has leaked out and that Russian troops are hearing of it.

Letters are given to show how the Bolshevik leaders and the German officers arranged for the assassination of Russian Nationalist leaders (Documents 35, 39, and 52), for the destruction of the Polish legionaries in the Russian army (Documents 40 to 42), for the disorganization of the Roumanian army and the deposing of the Roumanian king (Document No. 37), for the substitution of officers satisfactory to Germany in command of Russian troops instead of patriotic Russian generals (Documents 31 and 32), for the suppression of patriotic agitation among the Russian soldiers (Documents 13 and 14), for an attack upon the Italian ambassador in Petrograd and the theft of his papers (Documents 26 and 27), and for the employment of German soldiers in Russian uniforms against the Russian national armies in the South (Document 35).

Several of the letters are indorsed by Trotsky. Even standing alone, they are complete proof that the Bolshevik leaders were ruling as German agents in Russia, and obeying German orders to act against all Germany's enemies and even against Russia itself.

Acted as German Agents

Moreover, these Bolshevik leaders acted as German agents by suppressing their own socialist revolution in the Russian provinces where their doctrines interfered with German plans of annexation. Document 46 is the original letter from the Petrograd Intelligence Bureau of the German General Staff addressed to the Bolshevik Commissar of Foreign Affairs. It reads: "According to instructions of the representative of our General Staff, I have the honor once more to insist that you recall from Esthonia, Lithuania, and Courland all agitators of the Central Executive Committee of the Council of Workmen's and Soldiers' Deputies." And in Document 47 the General Staff orders the Bolsheviki to cease the agitation in Esthonia which had "finally led to the local German landlords being declared outlawed," and to "take immediate steps for the restoring of the rights of the above-mentioned German landlords."

Another group of letters (Nos. 33 to 36) shows how the Germans cheated the Bolshevik leaders in their dealings with the Ukraine and made a separate German peace with the anti-Bolshevik leaders in that Russian province. And another group shows the Germans assisting both sides of the civil war in Finland (Documents 38, 43, and 53).

The documents, as they follow, are given in the main in the report form in which they were transmitted by Mr. Sisson to Mr. Creel, chairman of the committee, with some later data added and carefully indicated. For instance, Mr. Sisson did not learn until several weeks after he had left Russia that the German order (which he possessed) naming the Russian who was to "defend" Petrograd had been obeyed.

In preparing this material for publication as a pamphlet advantage has been taken of the opportunity to improve in some mooted points the form in which the documents and translations are presented.

PART I

The German-Bolshevik Conspiracy

A REPORT BY

EDGAR SISSON

Special Representative in Russia of the Committee on Public Information in the Winter of 1917-18

CHAPTER I.

THE BASIC CONSPIRACY

Three groups of documents are subjected to internal analysis in the material that follows. One group consists of originals, one group consists of photographs of documents believed still to be in the file rooms of the Russian Bolsheviki, and the third (Appendix I) of typewritten circulars that have not been traced to their originals except perhaps in the case of two of the number. The chief importance of the third group is that its appearance inspired the efforts that led to the uncovering of the other groups. And they fit into the fabric of the whole.

The first set of these appendix circulars came into my hands on February 2, in Petrograd. An additional set appeared the following day at an office where I frequently called. A third appeared in another quarter a day afterwards. One set was in Russian and two in English. On February 5 I held all three sets. A possible explanation for their appearance at this time and their intent is given in Appendix I.

By themselves they were plausible but not substantiated. Having first performed the obvious duty of analyzing them for surface values and transmitting them and the analyses to Washington, I turned, therefore, to the task of further investigations.

It is not yet possible to name those who helped, but in three weeks' time the judgment of facts became apparent.

The text of the documents discloses both the methods and the effects of the German conspiracy not alone against Russia, but the world. With each document is the indication of whether it is an original or photograph. With each document is an interpretative note.

DOCUMENT NO. 1

People's Commissary for Foreign Affairs.

(*Very Secret*)

Petrograd, November 16, 1917.

To the Chairman of the Council of People's Commissars:

In accordance with the resolution passed by the conference of People's Commissars, Comrades Lenin, Trotsky, Podvoisky, Dybenko, and Volodarsky, the following has been executed by us:

1. In the archives of the Ministry of Justice from the dossier *re* "treason" of Comrades Lenin, Zinovieff, Koslovsky, Kollontai and others, has been removed the order of the German Imperial Bank, No. 7433, of the second of March, 1917, for allowing money to Comrades Lenin, Zinovieff, Kameneff, Trotsky, Sumenson, Koslovsky and others for the propaganda of peace in Russia.

2. There have been audited all the books of the Nia Bank at Stockholm containing the accounts of Comrades Lenin, Trotsky, Zinovieff, and others, which were opened by the order of the German Imperial Bank No. 2754. These books have been delivered to Comrade Müller, who was sent from Berlin.

Authorized by the Commissar for Foreign Affairs.

E. Polivanoff.
F. Zalkind.

Note.—*The Russian Council of People's Commissars was dominated by the president, Vladimir Ulianov (Lenin); the then foreign minister, Leon Trotsky, now war minister; and the ambassador to Germany, A. Joffe. The marginal indorsement in writing is: "To the secret department. B. U." This is the fashion in which Lenin is accustomed to initial himself. The English equivalent would be V. U., for Vladimir Ulianov. So, even if there existed no further record of German Imperial Bank order No. 7433, here would be the proof of its contents, and here is the link connecting Lenin directly with his action and his guilt. The content matter of the circular exists, however, and herewith follows:*

Order of the 2d of March, 1917, of the Imperial Bank for the representatives of all German banks in Sweden:

Notice is hereby given that requisition for money for the purpose of peace propaganda in Russia will be received through Finland. These requisitions will emanate from the following: Lenin, Zinovieff, Kameneff, Trotsky, Sumenson, Koslovsky, Kollontai, Sivers, and Merkalin, accounts for whom have been opened in accordance with our order No. 2754 in the agencies of private German businesses in Sweden, Norway, and Switzerland. All these requests should bear one of the two following signatures: Dirshau or Milkenberg. With either of these signatures the requests of the above-mentioned persons should be complied with without delay.—7433, Imperial Bank.

I have not a copy of this circular nor a photograph of it, but Document No. 2, next in order, proves its authenticity at once curiously and absolutely. Particular interest attaches to this circular because of Bolshevik public denial of its existence. It was one of several German circulars published in Paris in the "Petit Parisien" last winter. The Petrograd Bolshevik papers proclaimed it a falsehood. Zalkind, whose signature appears not only here but on the protocol (Document No. 3), was an assistant foreign minister. He was sent in February on a mission outside of Russia. He was in Christiania in April when I was there.

Have photograph of the letter.

DOCUMENT NO. 2

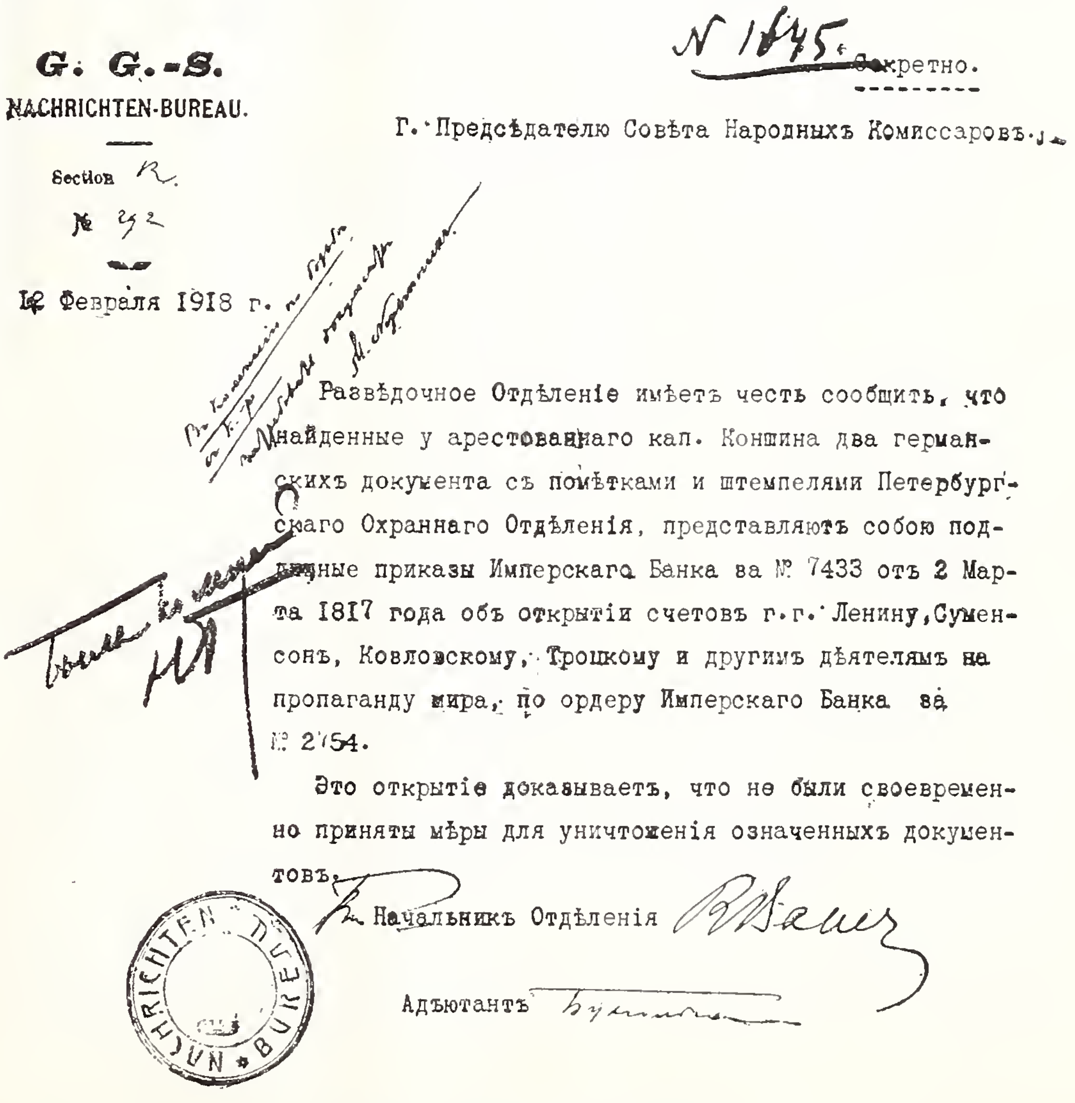
G[reat] G[eneral] S[taff], Intelligence [Nachrichten] Bureau, Section A, No. 292.

(*Secret*)

February 12, 1918.

To the Chairman of the Council of People's Commissars:

The Intelligence Bureau has the honor to inform you that there



N 1645. Секретно.

G. G.-S.
NACHRICHTEN-BUREAU.

Section R.
№ 292

12 Февраля 1918 г.

Г. Председателю Совѣта Народныхъ Комиссаровъ.

Развѣдочное Отдѣленіе имѣетъ честь сообщить, что найденные у арестованнаго кап. Коншина два германскихъ документа съ помѣтками и штемпелями Петербургскаго Охраннаго Отдѣленія, представляютъ собою подложные приказы Имперскаго Банка ва № 7433 отъ 2 Марта 1817 года объ открытіи счетовъ г.г. Ленину, Суменсонъ, Ковловскому, Троцкому и другимъ дѣятелямъ на пропаганду мира, по ордеру Имперскаго Банка ва № 2754.

Это открытіе доказываетъ, что не были своевременно приняты мѣры для уничтоженія означенныхъ документовъ.

Начальникъ Отдѣленія R. Bauer

Адъютантъ Бу

Facsimile of Document Number 2

were found on the arrested Capt. Konshin two German documents with notations and stamps of the Petersburg secret police [Okhrana] which show themselves to be the original orders of the Imperial Bank, No. 7433, March 2, 1917, concerning the opening of accounts for Messrs. Lenin, Sumenson, Koslovsky, Trotsky, and other active workers on the peace propaganda, by order No. 2754 of the Imperial Bank.

These discoveries show that at the proper time steps were not taken to destroy the above-mentioned documents.

For the head of the Bureau:
R. Bauer.
Adjutant: Bukholm.

Note.—*Observe the thoughtfulness with which Bauer, a careful man, set down exactly what was in the document, thereby permitting the contents to rise again from the ashes to which perhaps he committed the damaging paper. He admits that the documents found were truthful originals. The world will thank him and Germany will not.*

I have the original letter. It bears marginal indorsements: "Referred to the Commission for Combating Counter Revolution. Demanded documents. M. Skripnik"; and an illegible comment by N. Gorbunoff, Lenin's other Government secretary. The letter is directed to Lenin. Did Skripnik get the documents? I do not know.

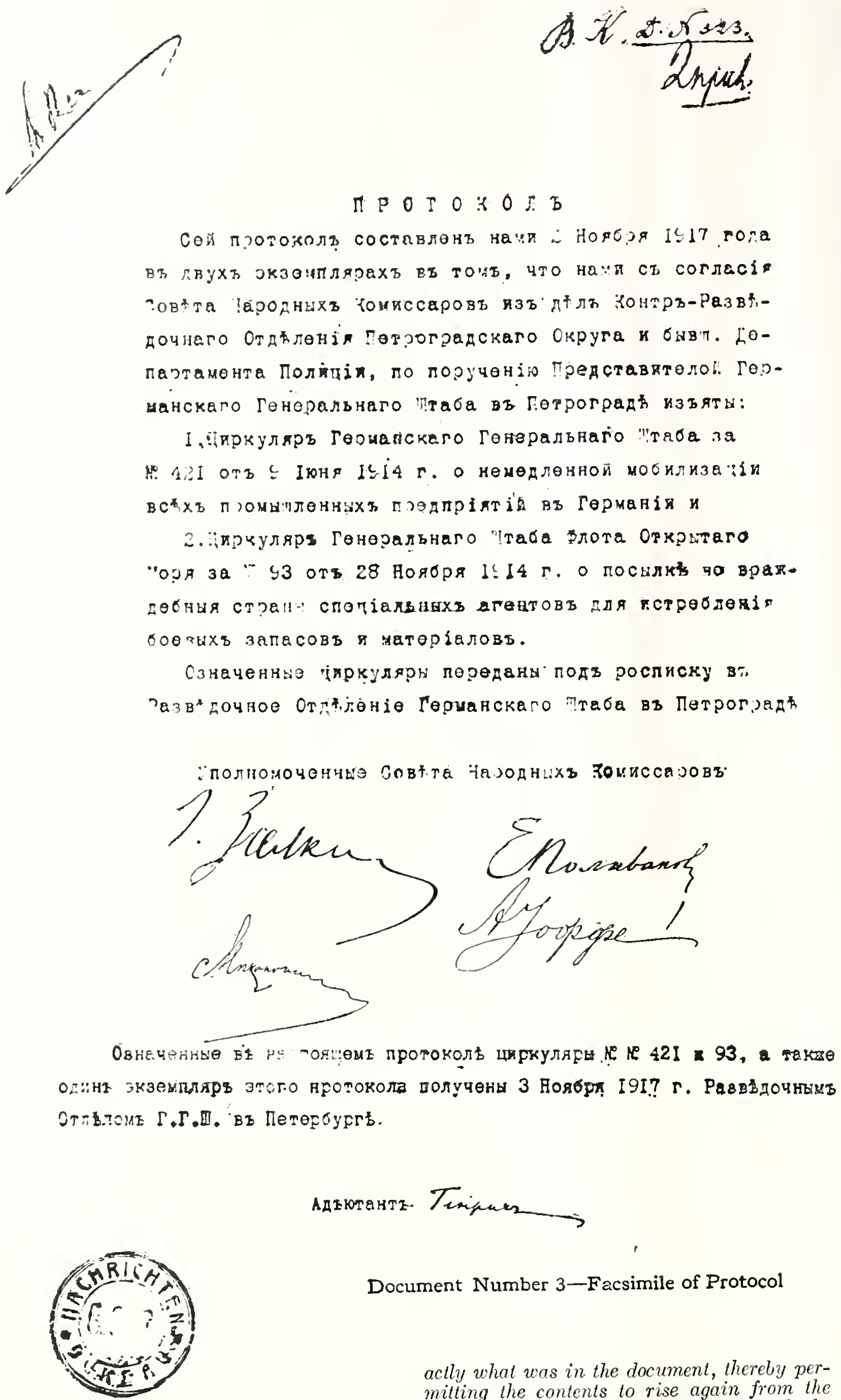
The letter is remarkable otherwise, for the arrested Capt. Konshin mentioned is a German officer, Lieut. Otto, who appears elsewhere as an agent in the German double-crossing intrigue in the Ukraine. What was behind the mystery of his arrest? What was his fate?

Note (Oct. 1, 1918).—*The order of the second of March, 1917, as pointed out in the note to Document 1, has had publicity since last winter, and naturally has been subject to the attack of the defenders of Lenin and Trotsky. The effort at confusion, however, is of the straw-man variety. If this date were in the Western European calendar, it would precede the March Revolution. So the defenders of Lenin and Trotsky have argued against the letter that it must have been written by a Counter-Revolutionary Russian who* forgot *the 13 days' difference in time between the Russian and the European calendar. Curiously, the persons who make this contention overlook the reverse of such an argument—that the order was written by a German who* knew and used *the Russian calendar. He ought in common sense to have used it, as the letter was written to state when orders for money from Russians would be honored.*

The Germans who maneuvered in Russia were letter perfect in Russian form (See Document 5, "who use the Russian language perfectly and who are acquainted with Russian conditions.")

But the date, March 2, may be either German or Russian, for any important bearing it has on the documents. If German, it was written before the March Revolution, but in preparation for getting into it as soon as it started. Many persons, both in Russia and in Germany, knew of an impending effort at Revolution. What more natural on Berlin's part than to desire to get its "agents-disturbers" there? And if they were at that moment widely scattered over the world, the more reason to begin quickly to call them in.

DOCUMENT NO. 3



В. К. Д. № 323.
2 прил.

ПРОТОКОЛЪ

Сей протоколъ составленъ нами 2 Ноября 1917 года въ двухъ экземплярахъ въ томъ, что нами съ согласія Совѣта Народныхъ Комиссаровъ изъ дѣлъ Контръ-Развѣдочнаго Отдѣленія Петроградскаго Округа и бывш. Департамента Полиціи, по порученію Представителей Германскаго Генеральнаго Штаба въ Петроградѣ изъяты:

I. Циркуляръ Германскаго Генеральнаго Штаба за № 421 отъ 9 Іюня 1914 г. о немедленной мобилизаціи всѣхъ промышленныхъ предпріятій въ Германіи и

2. Циркуляръ Генеральнаго Штаба Флота Открытаго Моря за № 93 отъ 28 Ноября 1914 г. о посылкѣ во враждебныя страны спеціальныхъ агентовъ для истребленія боевыхъ запасовъ и матеріаловъ.

Означенные циркуляры переданы подъ росписку въ Развѣдочное Отдѣленіе Германскаго Штаба въ Петроградѣ

Уполномоченные Совѣта Народныхъ Комиссаровъ

Означенные въ настоящемъ протоколѣ циркуляры №№ 421 и 93, а также одинъ экземпляръ этого протокола получены 3 Ноября 1917 г. Развѣдочнымъ Отдѣломъ Г.Г.Ш. въ Петербургѣ.

Адъютантъ

NACHRICHTEN-BUREAU

Document Number 3—Facsimile of Protocol

V. K. [Military Commissariat] D. No. 323—two inclosures.

PROTOCOL

This protocol, drawn up by us on the 2d of November, 1917, in duplicate, declares that we have taken with the consent of the Council of People's Commissars from the papers of the Department of Counter Espionage of the Petrograd district and the former Department of Police [Okhrana], on instructions of the representatives of the German General Staff in Petrograd:

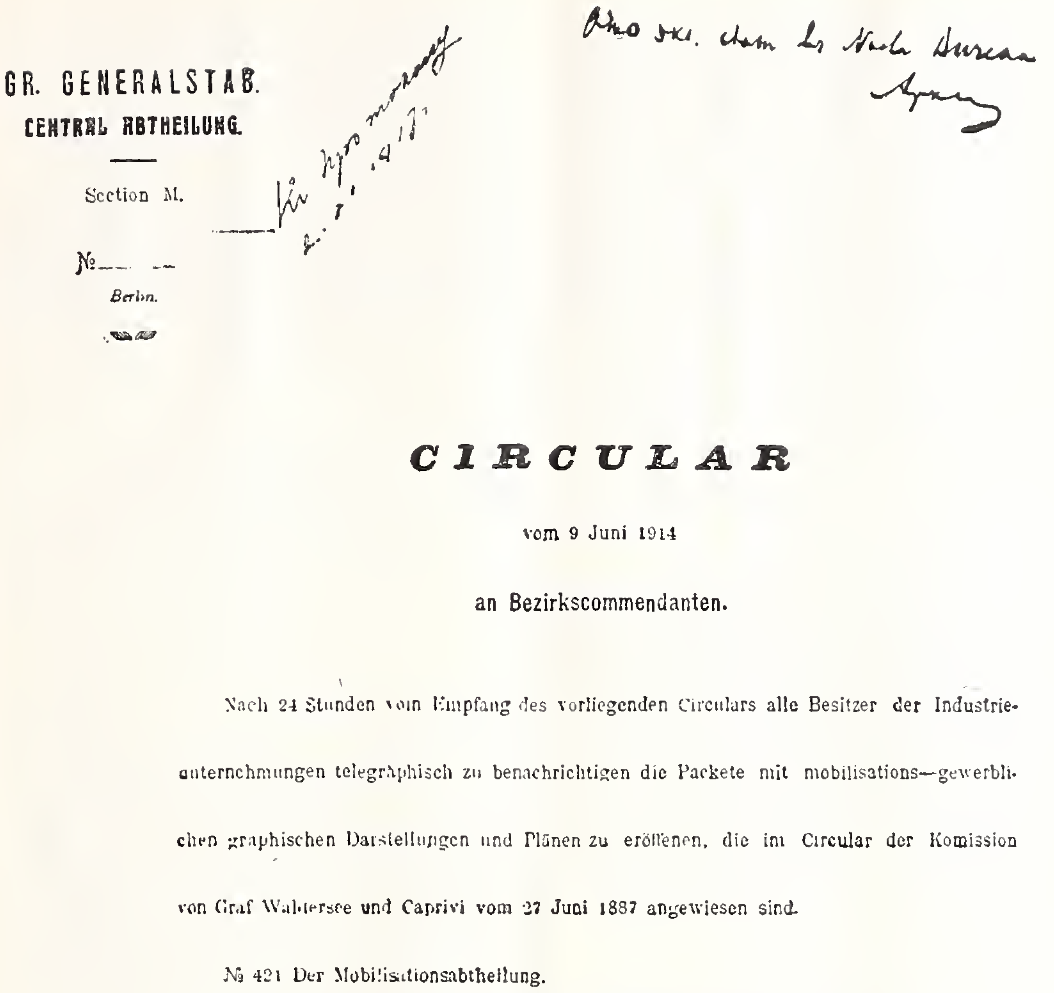
1. Circular of the German General Staff No. 421, dated June 9, 1914, concerning the immediate mobilization of all industrial enterprises in Germany, and
2. Circular No. 93, dated November 28, 1914, of the General Staff of the High Sea Fleet, concerning the sending into enemy countries of special agents for the destruction of war supplies and materials.

The above noted circulars were given over under signed receipt into the Intelligence Bureau of the German Staff in Petrograd.

Authorized by the Council of People's Commissars.
F. Zalkind.
E. Polivanoff.
(Illegible, but may be Mekhanoshin.)
A. Joffe.

The Circulars No. 421 and No. 93 mentioned in this protocol and also one copy of this protocol were received on the 3d of November, 1917, by the Intelligence Bureau of the G[reat] G[eneral] S[taff] in Petersburg.

Adjutant: Henrich.



GR. GENERALSTAB.
CENTRAL ABTHEILUNG.

Section M.

№— —

Berlin.

[illegible]

[illegible]

CIRCULAR

vom 9 Juni 1914

an Bezirkscommendanten.

Nach 24 Stunden vom Empfang des vorliegenden Circulars alle Besitzer der Industrieunternehmungen telegraphisch zu benachrichtigen die Packete mit mobilisations—gewerblichen graphischen Darstellungen und Plänen zu eröffenen, die im Circular der Komission von Graf Waltersee und Caprivi vom 27 Juni 1887 angewiesen sind.

№ 421 Der Mobilisationsabtheilung.

Document No. 3—Facsimile of June 9 Circular

NOTE.—*The circulars inclosed are printed in German, and are as follows:*

Gr[eat] General Staff, Central Division, Section M, No. —, Berlin.

CIRCULAR OF JUNE 9, 1914, TO DISTRICT COMMANDERS:

Within 24 hours of the receipt of this circular you are to inform all industrial concerns by wire that the documents with industrial mobilization plans and with registration forms be opened, such as are referred to in the circular of the Commission of Count Waldersee and Caprivi, of June 27, 1887.

No. 421, Mobilization Division.

G[eneral] S[taff] of the High Sea Fleet, No. 93.

CIRCULAR OF NOVEMBER 28, 1914, TO MARINE AGENCIES AND NAVAL SOCIETIES:

You are ordered to mobilize immediately all destruction agents and observers in those commercial and military ports where munitions are being loaded on ships going to England, France, Canada, the United States of North America, and Russia, where there are storehouses of such munitions, and where fighting units are stationed. It is necessary to hire through third parties who stand in no relation to the official representatives of Germany agents for arranging explosions on ships bound for enemy countries, and for arranging delays, embroilments, and difficulties during the loading, dispatching, and unloading of ships. For this purpose we are especially recommending to your attention loaders' gangs, among whom there are many anarchists and escaped criminals, and that you get in touch with German and neutral shipping offices as a means of observing agents of enemy countries who are receiving and shipping the munitions. Funds required for the hiring and bribing of persons necessary for the designated purpose will be placed at your disposal at your request.

Intelligence Bureau of the General Staff of the High Sea Fleet.

KOENIG.

NOTE.—*Both the circulars bear the penciled notation that "one copy has been given to the German Intelligence Bureau" at Petrograd. The German intent here was to remove from the records of the old Russian Government the evidence, first, that Germany was beginning in June, 1914, its active preparations for the war that surprised the world in August, 1914, and second, to remove the evidence of its responsibility for incendiarism and explosions in the United States, a country with which Germany was then at peace. The result was to give new evidence of the truth of the charges. The evident mixture of bad and good German in these circulars seems to me evidence of an attempt to provide an alibi against the almost inevitable day when the circulars would be revealed. (See also page 30.)*

Have original of protocol and have the printed circulars.

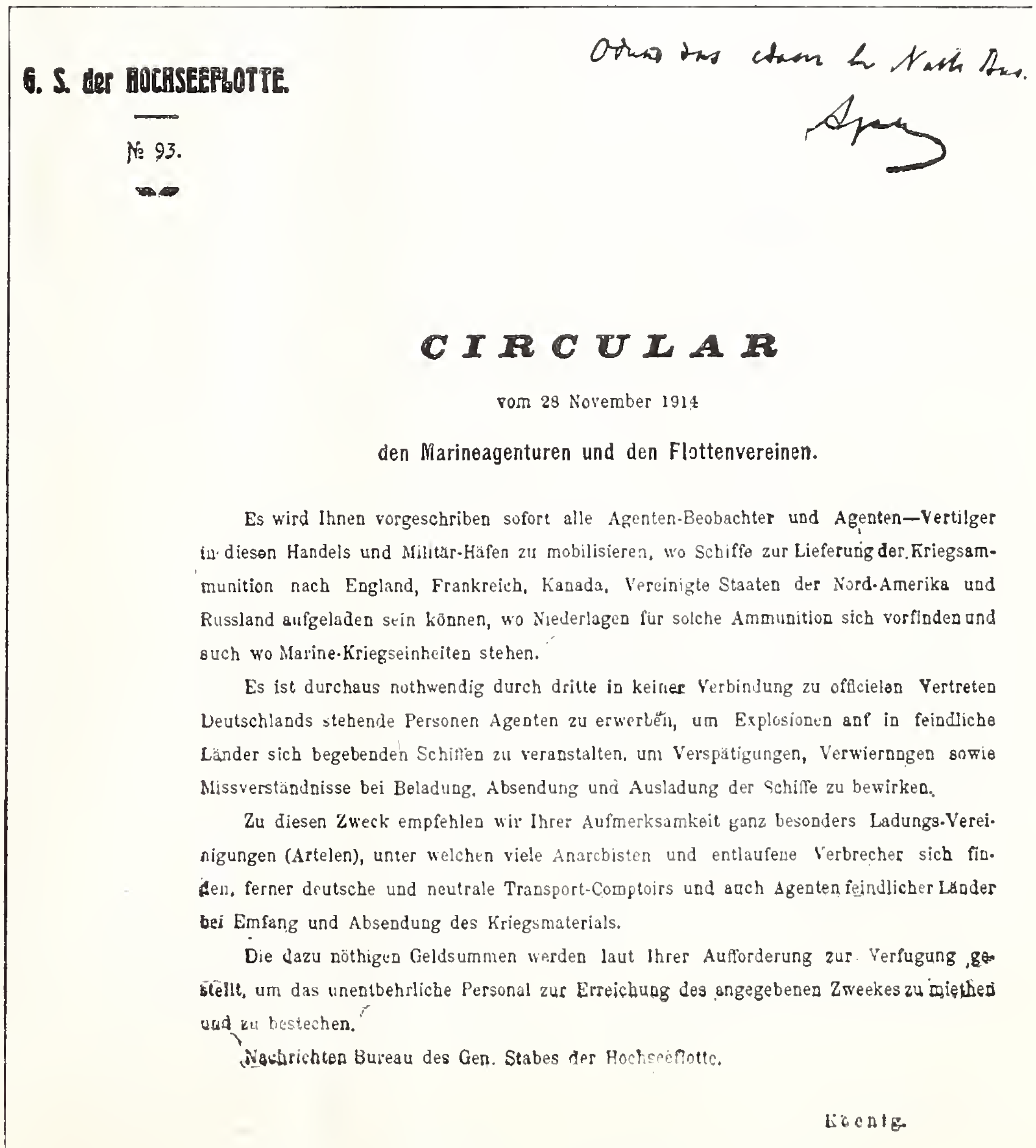
DOCUMENT NO. 4

G. G.-S., Intelligence Bureau, Section R, No. 35.

January 17, 1918.

TO THE COMMISSARIAT OF FOREIGN AFFAIRS:

The Bureau has received exact information that the leaders of the socialist party now ruling in Russia,



G. S. der HOCHSEEFLOTTE.

№ 93.

[illegible]

CIRCULAR

vom 28 November 1914

den Marineagenturen und den Flottenvereinen.

Es wird Ihnen vorgeschriben sofort alle Agenten-Beobachter und Agenten—Vertilger in diesen Handels und Militär-Häfen zu mobilisieren, wo Schiffe zur Lieferung der Kriegsammunition nach England, Frankreich, Kanada, Vereinigte Staaten der Nord-Amerika und Russland aufgeladen sein können, wo Niederlagen für solche Ammunition sich vorfinden und auch wo Marine-Kriegseinheiten stehen.

Es ist durchaus nothwendig durch dritte in keiner Verbindung zu officielen Vertreten Deutschlands stehende Personen Agenten zu erwerben, um Explosionen anf in feindliche Länder sich begebenden Schiffen zu veranstalten, um Verspätigungen, Verwiernngen sowie Missverständnisse bei Beladung, Absendung und Ausladung der Schiffe zu bewirken.

Zu diesen Zweck empfehlen wir Ihrer Aufmerksamkeit ganz besonders Ladungs-Vereinigungen (Artelen), unter welchen viele Anarcbisten und entlaufene Verbrecher sich finden, ferner deutsche und neutrale Transport-Comptoirs und auch Agenten feindlicher Länder bei Emfang und Absendung des Kriegsmaterials.

Die dazu nöthigen Geldsummen werden laut Ihrer Aufforderung zur Verfugung gestellt, um das unentbehrliche Personal zur Erreichung des angegebenen Zweekes zu miethen und zu bestechen.

Nachrichten Bureau des Gen. Stabes der Hochseeflotte.

Koenig.

Document No. 3—Facsimile of November 28 Circular through Messrs. Fuerstenberg and Radek, are in correspondence with Messrs. Scheidemann and Parvus regarding the destruction of the traces of the business relations of the party with the Imperial Government. We also know that this correspondence was caused by the demand of leading groups of German socialists, who saw in the said communications a danger to the cause of world socialism. By order of the staff, I have the honor to request the submitting of this question to special discussion in the presence of the representative of our staff and Mr. von Schoenemann.

For the head of the department:
R. Bauer.
Adjutant: [Illegible.]

Note.—*The world penalty, therefore, was apparent to some Germans. Of the personalities named in the letter, Scheidemann, the leader of the German Government-supporting wing of the Socialist party is the most notable. Once before he has been named in relation to the "business relations" of the Russian Bolsheviki with the Imperial Government, writing a letter from Copenhagen in 1917, to a "Mr. Olberg" in which he stated that 150,000 kroners had been placed at Olberg's disposal at Fuerstenberg's office through the Nia Bank. (See Appendix, later.) Now Fuerstenberg by this time, January, in Petrograd at Smolny, is trying to help Scheidemann in covering up old trails. Radek is a clever Polish-Austrian Jew who came from Switzerland with Lenin. He and Trotsky between them staged the public play-acting at Brest-Litovsk. Von Schoenemann was the accredited German representative to the Bolshevik foreign office. He is named later in Document No. 5. Parvus is a handler of German propaganda money, with headquarters at Copenhagen, and is credited with being the directing force behind Joffe. (For Parvus, see "New Europe," January 31, 1918, pp. 94-95.)*

Have photograph of this letter.

DOCUMENT NO. 5

Gr[eat] General Staff, Central Division, Section M, No. (blank), Berlin.

October 25, 1917.

To the Government of People's Commissars:

In accordance with the agreement which took place in Kronstadt, in July of the present year, between officials of our General Staff and leaders of the Russian revolutionary army and democracy, Messrs. Lenin, Trotsky, Raskolnikov, and Dybenko, the Russian Division of our General Staff operating in Finland is ordering to Petrograd officers for the disposal of the Intelligence Bureau of the staff. At the head of the Petrograd Bureau will be the following officers, who use the Russian language perfectly and who are acquainted with Russian conditions:

Maj. Luberts, cipher signature Agasfer.
Maj. von Boelke, cipher signature Schott.
Maj. Bayermeister, cipher signature Ber.
Lieut. Hartwig, cipher signature Henrich.

The Intelligence Bureau, in accordance with the agreement with Messrs. Lenin, Trotsky, and Zinovieff, will have the surveillance of the foreign embassies and military missions and of the counter revolutionary movement, and also will perform the espionage and counter espionage work on the internal fronts, for which purpose agents will be assigned to the various cities.

Coincidently, it is announced that at the disposal of the Government of People's Commissars are assigned consultants to the Ministry of Foreign Affairs, Mr. von Schoenemann, and to the Ministry of Finance, Mr. von Toll.

Chief of the Russian Division, German General Staff: O. Rausch.
Adjutant: U. Wolff.

(And below on the same letter:)

To the Commissariat of Foreign Affairs:

The officers indicated in this paper have been before the military revolutionary committee and have agreed on conditions with Muravieff, Boie, and Danishevski with regard to their mutual activities. They have all come under the direction of the committee. The consultants will appear as called for.

Chairman Military Revolutionary Committee, Council of Workers' and Soldiers' Deputies: A. Joffe.
Secretary: P. Krushavitch.

October 27, 1917.

Note.—*Here is the working compact. If Rausch was then in Berlin he presumably came immediately afterwards to Petrograd. It is more probable that the letter was written in Finland than Berlin. In some other letterheads on which Berlin is printed the word is run through with a pen. Stationery was hard to get in Petrograd. Maj. Luberts became the head of the Intelligence Bureau (Nachrichten Bureau). Kronstadt was the midsummer headquarters of Lenin. Raskolnikoff will be referred to in connection with the project to sell the Russian fleet to Germany. Dybenko was the commissar of the fleet, the naval minister, a driving man and keen witted. Zinovieff is the president of the Petrograd Soviet, during the winter the most powerful of the local bodies of the Russian Soviets. He is Jewish and well educated. Joffe, in the letter of Bolshevik acceptance of the German compact, again stands forth for what he is, the spokesman, after Lenin, in all matters of supreme importance to Germany.*

Have photograph of the joint letter.

DOCUMENT NO. 6

Gr[eat] General Staff, Central Division, No. 813.

November 19, 1917.

To the Council of People's Commissars:

This is to advise you that the following persons have been put at the disposal of the Russian Government as military advisers: Maj. Erich, Maj. Bode, Maj. Sass, Maj. Zimmerman, Maj. Anders, Lieut. Haase, Lieut. Klein, Lieut. Breitz.

These officers will choose a cadre of the most suitable officers from the list of our prisoners, who will likewise be at the disposal of the Russian Government, as was agreed at the conference in Stockholm when Lenin, Zinovieff, and others were traveling through to Russia.

Head of the Russian Section, German General Staff: O. Rausch.
Adjutant: U. Wolff.

Note.—*Maj. Anders took the Russian name Rubokov and Maj. Erich the Russian name Egorov. Lenin and Zinovieff passed through Germany and Stockholm together.*

Have photograph of letter.

DOCUMENT NO. 7

G. G.-S., Intelligence Bureau, Section R, No. 27.

(Confidential)

January 12, 1918.

To the Commissar of Foreign Affairs:

By the order of the local department of the German General Staff, the Intelligence Department has reported the names and the characteristics of the main candidates for the reëlection of the Central Executive Committee. The General Staff orders us to insist on the election of the following persons: Trotsky, Lenin, Zinovieff, Kameneff, Joffe, Sverdlov, Lunacharsky, Kollontai, Fabrizius, Martov, Steklov, Golman, Frunze, Lander, Milk, Preobrajenski, Sollers, Studer, Golberg, Avanesov, Volodarsky, Raskolnikov, Stuchka, Peters, and Neubut. Please inform the president of the council of the General Staff's wish.

Head of the Bureau: Agasfer.
Adjutant: Henrich.

Note.—*The indorsements are: "Copy handed to chairman Council Workmen's and Soldiers' Deputies, No. 956." "Deliver to Comrade Zinovieff and to secret department. M. Ov——(?)" January 12 (Russian calendar) fell in the week of the All-Russian Soviet convention in Petrograd, the week after the forcible dissolution of the Constituent Assembly. The election came at the end of the week and was a perfunctory re-election of practically the whole former executive committee of commissars. Lacking the exact list, I nevertheless can state that the present executive committee was drafted from this group. The name there surprising to me is that of Martov, the head of a supposedly separate faction.*

Martov is an able writer, was associated with Trotsky in his Paris journalistic venture, but was supposed to have split with him in Russia. The evidence that he is still agreeable to Germany is pertinent. Madame Kollontai, the only woman on this list, was the Commissar of Public Welfare. She was sent abroad for foreign propaganda in February, but did not get beyond Scandinavia and later returned to Russia. Kameneff, who went out of Russia with Kollontai, also sought to return, but was arrested by the Finnish White Guards (not the Germans) on the Aland Islands, and his release was the subject of negotiations. He is Trotsky's brother-in-law. Sverdlov was temporary chairman of the All-Russian Soviet. Lunacharsky is Commissar of Education. Steklov is editor of the official paper "Isvestia." Volodarsky, who has lived in the United States, was in close confidence with Lenin. He was killed in Moscow the last week in June. Agasfer, who delivered the order in behalf of Rausch, is Maj. Luberts.

Have photograph of letter.

CHAPTER II.

RÔLE OF THE REICHSBANK

The following documents show in detail how the German Government financed the Russian Bolshevik revolution through the German Imperial Bank.

They show what rewards the German financial and industrial interests demanded in return for the German support of the Bolsheviki. And they show how the Bolshevik leaders betrayed their own followers and abandoned the preaching of their social revolution wherever the Germans ordered that it should be abandoned.

DOCUMENT NO. 8

Imperial Bank [Reichsbank], No. 2.
(*Very Secret*)
January 8, 1918.

To the People's Commissar of Foreign Affairs:

Notification has to-day been received by me from Stockholm that 50,000,000 roubles of gold has been transferred to be put at the disposal of the representatives of the People's Commissars. This credit has been supplied to the Russian Government in order to cover the cost of the keep of the Red Guards and agitators in the country. The Imperial Government considers it appropriate to remind the Council of People's Commissars of the necessity of increasing their propaganda in the country, as the antagonistic attitude of the south of Russia and Siberia to the existing Government in Russia is troubling the German Government. It is of great importance to send experienced men everywhere in order to set up a uniform government.

Representative of the Imperial Bank:
G. von Schanz.

Note.—*Members of the Red Guard were paid from 12 to 16 roubles a day, whereas soldiers were paid hardly that number of kopecks. This letter shows where the money came from. The Bolshevik Government also required factory owners to pay regular wages to their workers while the latter served in the Red Guard. The notation on letter indicates that it was referred to Menshinski, the financial minister, whose expert councillor was the German, von Toll. Menshinski personally conducted the wrecking of the Russian banks, a maneuver that deprived all opponents of Bolshevikism of their financial means of warfare. It was a classic job of destruction, done in the name of reconstruction.*

Have photograph of this letter.

DOCUMENT NO. 9

Imperial Bank, No. 8, Berlin.
(*Very Secret*)
January 12, 1918.

To the Commissar of Foreign Affairs:

I am instructed to convey the agreement of the Imperial Bank to the issue out of the credit of the General Staff of 5,000,000 roubles for the dispatch of the assistant naval commissar, Kudriashoff, to the Far East.

On arrival at Vladivostok he should visit the retired officer of the Russian Fleet, Mr. Panoff, and instruct Buttenhoff and Staufacher, who are known to Panoff, to come to see him. Both the mentioned agents will bring with them Messrs. Edward Shindler, William Keberlein, and Paul Diese [or Deze]. With these persons it is necessary to think out a plan for carrying out the Japanese and American war materials from Vladivostok to the west. If this is not possible then they must instruct Diese [or Deze] and his agents to destroy the stores. Shindler must acquaint Kudriashoff with the Chinese agents at Nikolsk. These persons should receive the agreed amounts and should be dispatched to China to carry on an agitation against Japan.

Representative of the Imperial Bank:
G. von Schanz.

Note.—*If this plan was developed to a climax it was not by Kudriashoff. He was killed on his passage through Siberia two or three weeks later and it was reported that a great sum of money was taken from his body by his murderers, who were said to be two Cossacks. Most of the German agents named in this letter were still active in Siberia in the spring, as shown by Document No. 29.*

Have photograph of this letter.

DOCUMENT NO. 10

Imperial Bank, No. 5.
January 11, 1918.

To the Chairman of the Council of People's Commissars:

My Dear Mr. Chairman: The industrial and commercial organizations in Germany interested in trade relations with Russia have addressed themselves to me in a letter, including several guiding indications. Permit me to bring them to your attention.

1. The conflict of the Russian revolution with the Russian capitalists absolutely dees not interest German manufacturing circles, in so far as the question does not concern industry as such. You can destroy the Russian capitalists as far as you please, but it would by no means be possible to permit the destruction of Russian enterprises. Such a situation would produce a constant ferment in the country, supported by famine of materials and, in consequence of that, of products also. The English, American, and French capitalists take advantage of this disorder and understand how to establish here corps of their commercial agents. It is necessary to remember that German industry in the first years after the general peace will not be in a position to satisfy the purchasing demand of the Russian market, having broad similar parallel tasks in the Near East, in Persia, in China, and in Africa.

2. It is essential, therefore, to conduct a canvass and gather statistical information with regard to the condition of industry, and, in view of the absence of money in Russia, to address in business conversations whichever is desired of the groups of German commercial banks.

3. Trade with Germany may be in the first period almost exclusively exchange for wheat and for any remaining products to receive household necessities. Everything which exceeds the limits of such trade should be paid for in advance to the amount of 75 per cent of the market value, with the payment of the remaining quarter in a six months' period. In place of such an arrangement, probably, it would seem to be possible to permit, privately, the taking of German dividend shares on the Russian financial market, or solidly guaranteed industrial and railroad loans.

In view of the indicated interest of German manufacturers and merchants to trade relations in Russia, I cordially beg you, Mr. Chairman, to inform me of the views of the Government regarding the questions touched upon, and to receive the assurances of my sincere respect.

Representative of the Imperial Bank and Stock Exchange in Berlin:
G. von Schantz.

Note.—*The engaging attitude of the German manufacturers toward Russian capitalists is the feature of this letter, apart from the cordial and evidently understanding expressions of the representative of the German Imperial Bank to that opposed enemy of the capitalists of all nations, Lenin. The letter was sent to the secret department by Secretary Skripnik. Perhaps some day von Schanz will disclose Lenin's answer.*

Have photograph of letter.

DOCUMENT NO. 11

Imperial Bank, No. 12378.
[Printed circular in Russian]

RESOLUTION

of a conference of representatives of the German commercial banks convened on proposal of the German delegation at Petrograd by the management of the Imperial Bank, to discuss the resolutions of the Rhine-Westphalian Industrial Syndicate and Handelstag.

Berlin, December 28, 1917.

1. All loans are canceled the bonds of which are in the hands of German, Austrian, Bulgarian, and Turkish holders, but payment must be realized by the Russian treasury in the course of a 12-months' term after the conclusion of separate peace.

2. The purchase is permitted of all Russian securities and dividend-bearing paper by the representatives of the German banks at the rate of the day on the open market.

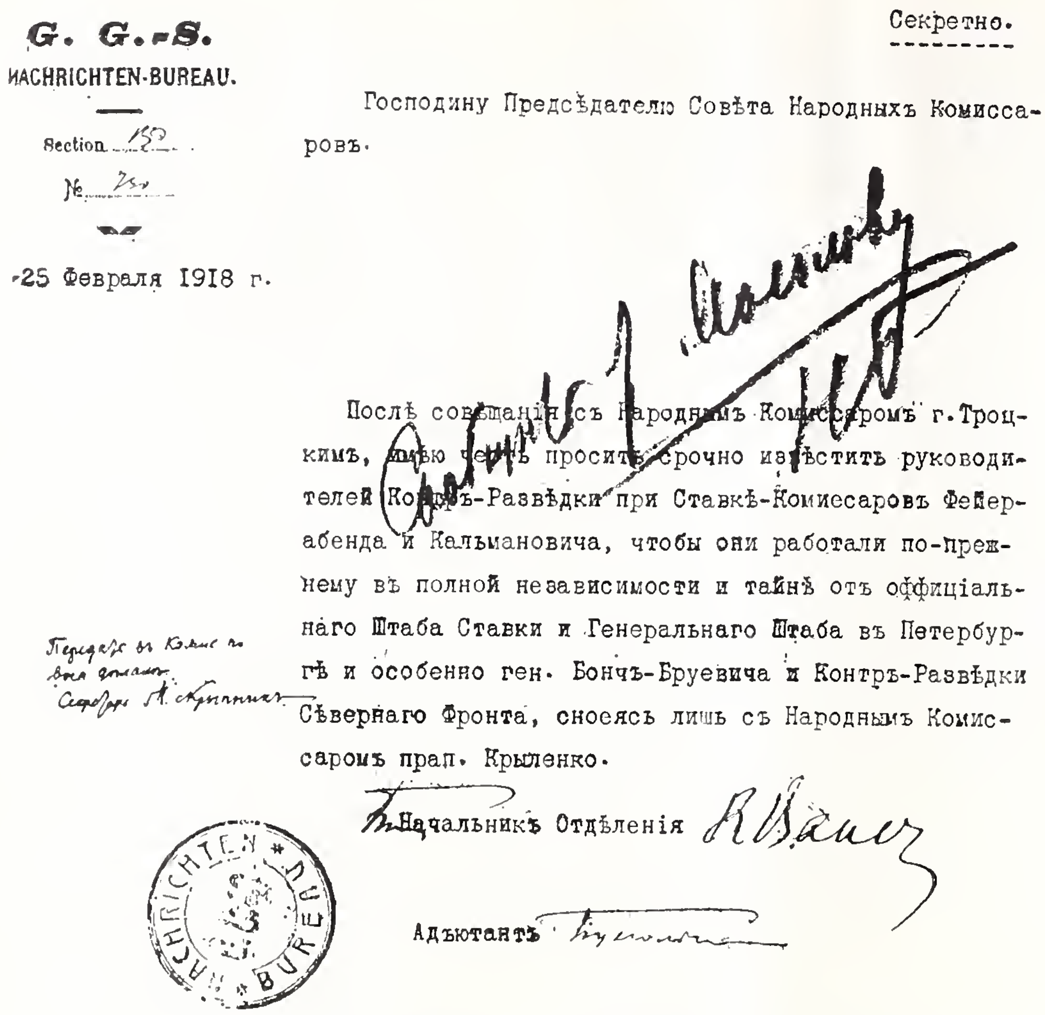
3. After the conclusion of separate peace, on the expiration of 90 days, there are reestablished all the shares of private railway companies, metallurgical industries, oil companies, and chemical pharmaceutical works.

Note.—The rating of such papers will be made by the German and Austrian stock exchanges.

4. There are banished and for five years from date of signing peace are not to be allowed English, French, and American capitals in the following industries: Coal, metallurgical, machine building, oil, chemical, and pharmaceutical.

5. In the question of development in Russia of coal, oil, and metallurgical branches of industry there is to be established a supreme advisory organ consisting of 10 Russian specialists, 10 from the German industrial organizations and the German and Austrian banks.

6. The Russian Government must not interfere in the region of questions connected with the transfer to the benefit of Germany of two mining districts in Poland—Dombroski and



G. G.-S.
NACHRICHTEN-BUREAU.

Section 12
№ 750

25 Февраля 1918 г.

Секретно.

Господину Предсѣдателю Совѣта Народныхъ Комиссаровъ.

Сообщить Мошолову Н. Г.

Послѣ совѣщанія съ Народнымъ Комиссаромъ г. Троцкимъ, имѣю честь просить срочно извѣстить руководителей Контръ-Развѣдки при Ставкѣ-Комиесаровъ Фейерабенда и Кальмановича, чтобы они работали по-прежнему въ полной независимости и тайнѣ отъ оффиціальнаго Штаба Ставки и Генеральнаго Штаба въ Петербургѣ и особенно ген. Бончъ-Бруевича и Контръ-Развѣдки Сѣвернаго Фронта, сносясь лишь съ Народнымъ Комиссаромъ прап. Крыленко.

Передать въ Комис. по воен. дѣлам. Секретарь М. Скрипникъ

За Начальникъ Отдѣленія R. Bauer

Адъютантъ Бухольм

Facsimile Document Number 12

Olkishski—and to Austria of the oil region in Galicia. The transfer of the latter will be only in the form of limitations of the right of making claims, land allotments, and application of capital for the production and refining of oil.

7. Germany and Austria enjoy the unlimited privilege of sending into Russia mechanics and qualified workmen.

8. Other foreign mechanics and workmen during five years after the conclusion of peace between Russia and Germany are not to be allowed to enter at all.

9. The statistical department of producing and manufacturing industries with the corresponding Government organ must be controlled by German specialists.

10. Private banks in Russia arise only with the consent and according to the plan of the Union of German and Austrian Banks, whereby the rating of the stocks of the banks on all exchanges of the New and Old World will be handled by the group of the Deutsche Bank.

11. At the ports of Petrograd, Archangel, Odessa, Vladivostok, and Batum will be established, under the leadership of specialists from Germany, special statistical economic committees.

As regards the tariff, railway and shipping rate policies to regulate the Russo-German-Austrian trade relations, this part of the economical treaty will be discussed by the special Tariff Council of the Handelstag.

Signed:
Chairman: von Grenner.
Secretary: Berenbluet.

Note.—*The penned indorsement on the photographed copy of the resolution is: "Chairman of the Central Executive Committee: Commissar Menshinsky requests that this resolution should be taken under advisement, and to prepare the ground in the Council of the Workmen's and Soldiers' Deputies, in case the Council of People's Commissars will not accept these requests. Secretary D. Khaskin." Menshinsky is Minister of Finance. All of these terms, wholly punitive to American, English, and French capital, could lurk in the secret section in the present German-Russian treaty. I do not know the fate of the resolution on this, its early winter appearance.*

Have besides the notated photograph a printed copy of this circular.

DOCUMENT NO. 12

G[reat] G[eneral] S[taff], Intelligence Bureau, Section R, No. 780.

Feb. 25, 1918.

(*Secret*)

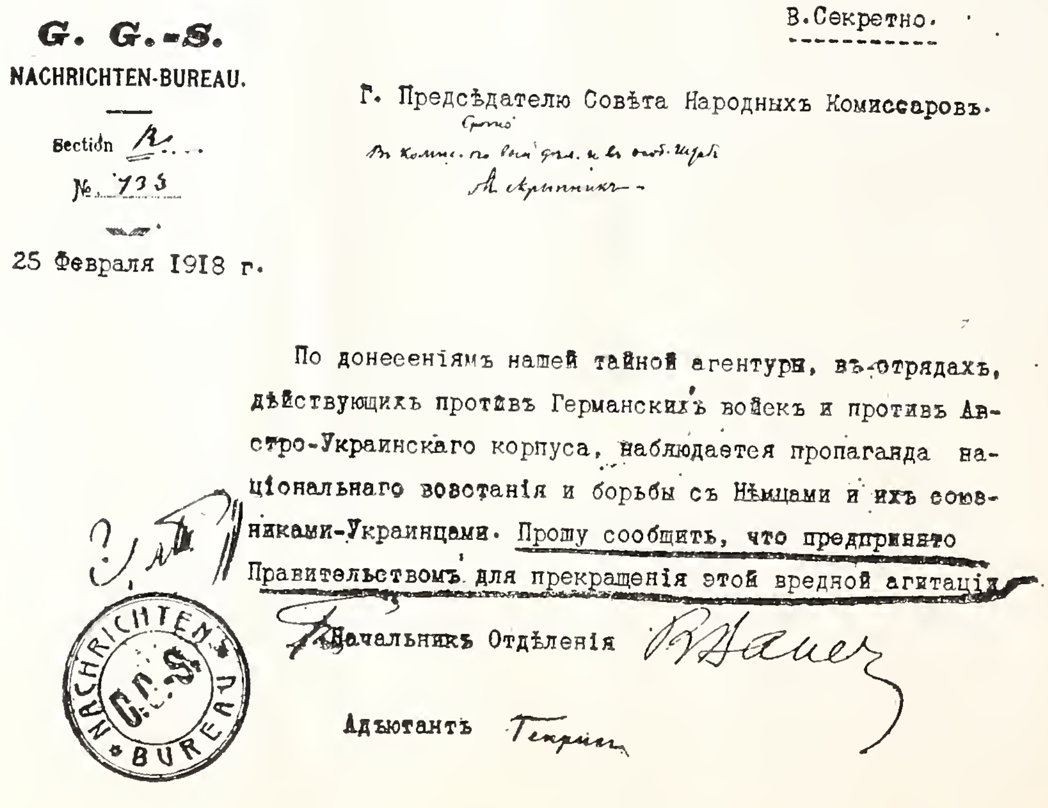
To the Chairman of the Council of People's Commissars:

After conferring with the People's Commissar Trotsky, I have the honor to ask you urgently to inform the directors of the Counter Espionage at Army Headquarters [Stafka], Commissars Feierabend and Kalmanovich, that they should work as formerly in complete independence and without the knowledge of the official staff at Army Headquarters and the General Staff in Petersburg, and particularly Gen. Bonch-Bruevich and the secret service of the northern front, communicating only with the People's Commissar Lieut. Krilenko.

For the head of the Bureau:
R. Bauer.
Adjutant: Bukholm.

Note.—*Across the letter is written: "Inform Mosholov. N. G." (Gorbunoff's initials). In the margin is written: "Passed on to the Commissar of War. M. Skripnik." The significance of this letter is that it is to Lenin; that the two chief secretaries of himself and the council passed it on for action; and that Trotsky and Lenin on February 27 were continuing to hamper the Russian commander at a moment when the German army was threatening Petrograd. Mosholov was one of the commissars on the staff of Krilenko, the commissar representing the Council of Commissars in the command of the Russian military forces. His achievements as a disorganizer were notable. This letter indicates that he had the confidence of Germany.*

Have original letter.



G. G.-S.
NACHRICHTEN-BUREAU.

Section R.
№ 733

25 Февраля 1918 г.

В. Секретно.

Г. Предсѣдателю Совѣта Народныхъ Комиссаровъ.

Срочно
Въ Комис. по воен. дѣл. и въ опер. Штабъ
М. Скрипникъ

По донесеніямъ нашей тайной агентуры, въ отрядахъ, дѣйствующихъ противъ Германскихъ войскъ и противъ Австро-Украинскаго корпуса, наблюдается пропаганда національнаго возстанія и борьбы съ Нѣмцами и ихъ союзниками-Украинцами. Прошу сообщить, что предпринято Правительствомъ для прекращенія этой вредной агитаціи.

За Начальникъ Отдѣленія R. Bauer

Адъютантъ Генрих

Facsimile Document Number 13

DOCUMENT NO. 13

G[reat] G[eneral] S[taff], Intelligence Bureau, Section R, No. 733.

February 25, 1918.

(Very Secret)

To the Chairman of the Council of People's Commissars:

According to reports of our secret agency in the detachments operating against the German troops and against the Austrian Ukrainian corps, there has been observed propaganda for a national rising and a struggle with the Germans and their allies, the Ukrainians. I ask you to inform me what has been done by the Government to stop this harmful agitation.

For the head of the Bureau:
R. Bauer.
Adjutant: Henrich.

Note.—*Across the top is written: "Urgent. To the Commissars of War and Special Staff. M. Skripnik." The last sentence is underscored, and in the margin appears a question mark, initialed "L. T." The first is Lenin's order through the secretary, and the second may possibly be taken as Trotsky's opposition to any action. The loss of the Ukraine by counter German intrigue was a sore point in prestige with him. But his essential obedience to Germany was not lessened.*

Have original letter.

DOCUMENT NO. 14

G. G.-S., Intelligence Bureau, Section R. No. 278/611.

To the People's Commissar of Foreign Affairs:

February 7, 1918.

According to information of the Intelligence Bureau it has been ascertained that the promise given personally by you, Mr. Commissar, in Brest-Litovsk, not to circulate socialistic agitational literature among the German troops is not being fulfilled. I ask you to inform me what steps will be taken in this matter.

For the head of the Bureau:
R. Bauer.
Adjutant: Henrich.

Note.—*Brusque words to the foreign minister of the Soviet Government of Workmen, Soldiers, and Sailors of the Russian Republic, delivered not by an equal in official rank, but by the deputy of a German major at the head of an intelligence department of the German Government. Did Trotsky resent or deny the imputation? Instead he wrote with his own hand in the margin: "I ask to discuss it. L. T." Thus he admits that he did give the promise at Brest-Litovsk. The question raised concerns only the measure of obedience to be required.*

Have original letter.

DOCUMENT NO. 15

Counter Espionage at Army Headquarters [Stavka], No. 311, special section.

To the Chairman of the Council of People's Commissars:

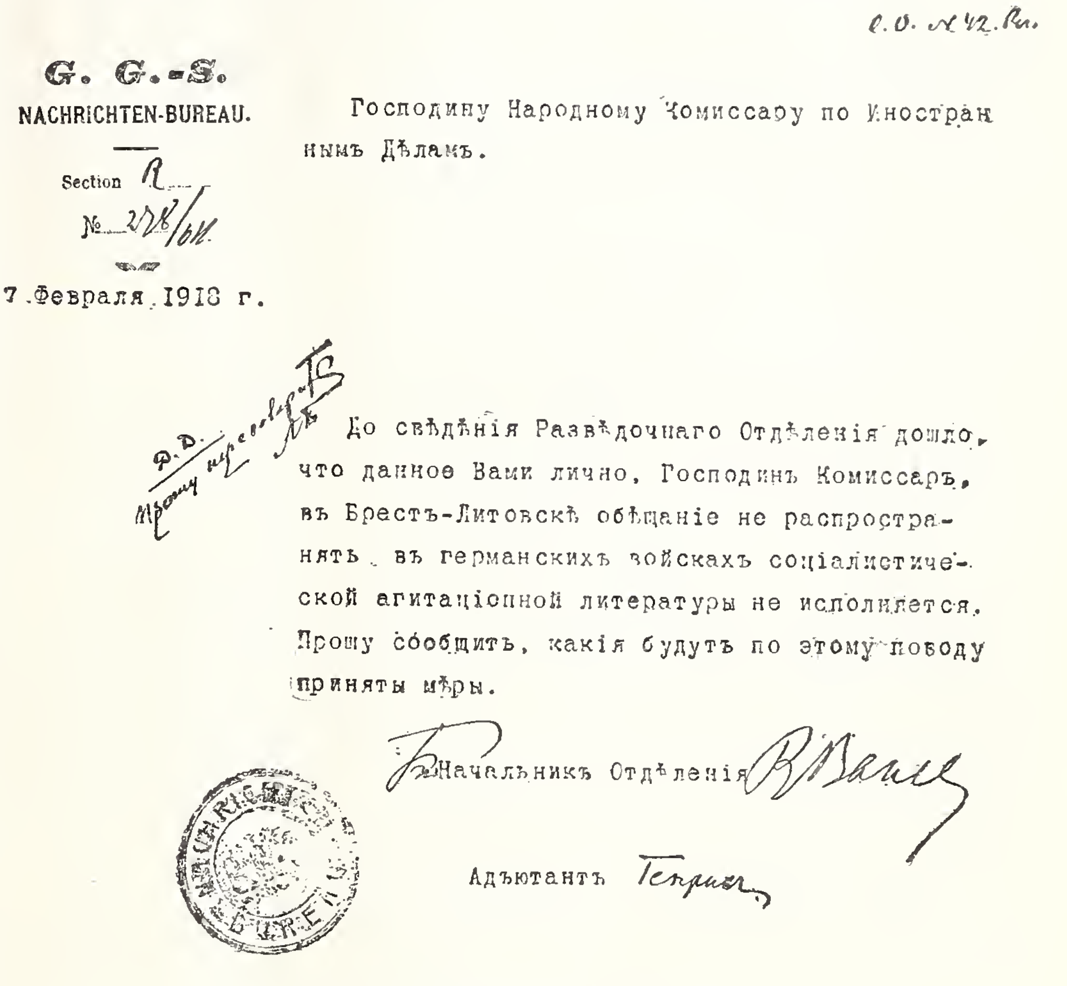
January 29, 1918.

The Counter Espionage at the Army Headquarters advises that at the front is being spread by unknown agitators the following counter revolutionary literature:

1. The text of circulars of various German Government institutions with proofs of the connection of the German Government with the Bolshevik workers before the passing of the Government into their hands. These leaflets have reached also the German commanders.

The Supreme Commander has received a demand from Gen. Hoffman to stop this dangerous agitation by all means possible.

2. A stenographic report of the conversation of Gen. Hoffman with Comrade Trotsky, whereby it was supposedly proposed to the latter to make peace on conditions of considerable concessions on the part of the Central Empires, but on the obligation of the Russian delegation to stop the socialization of the life of the state. Comrade Trotsky supposedly offered the termination of war without peace and the demobilization of our army. When Gen. Hoffman announced that the Germans would continue the advance, Trotsky supposedly replied: "Then under the pressure of force we shall be forced to make peace and fulfill all demands."



С.О. №42.Ru.

G. G.-S.
NACHRICHTEN-BUREAU.
Section R
№ 278/611
7 Февраля 1918 г.

Господину Народному Комиссару по Иностранным Дѣламъ.

Ф.Д. Прошу переговорить Л.Т.

До свѣдѣнія Развѣдочнаго Отдѣленія дошло, что данное Вами лично, Господинъ Комиссаръ, въ Брестъ-Литовскѣ обѣщаніе не распространять въ германскихъ войскахъ соціалистической агитаціонной литературы не исполняется. Прошу сообщить, какія будутъ по этому поводу приняты мѣры.

За Начальникъ Отдѣленія R Bauer

Адъютантъ Генрихъ

Facsimile Document Number 14

This document has created indignation among the troops. Against the Council of People's Commissars are heard cruel accusations.

Commissar: S. Kalmanovich.

Note.—*This letter is a warning of the slow rising but coming storm that will sweep these boldest pirates of history from the country they have temporarily stolen. To get a real understanding of the meaning of the second, and important, section of the letter, it must be pointed out that until February 1, the Russian calendar was 13 days behind the Western European calendar. The real date of this letter, therefore, is February 10. This is the date Trotsky's "No peace; no war" pronouncement was made at Brest-Litovsk. The news of it did not reach even Petrograd until the next day. Yet on that day printed circulars were being distributed at the front stating that Trotsky had agreed to do the very thing he did do, and giving an augury of events that did take place a week later when Germany did begin its advance and when the Bolsheviks did fulfill all demands. The fact is that simple truth was being told. Nor is the means by which it was secured at all obscure. A few daring and skillful Russians had found a means to get information from Brest-Litovsk.*

The circulars referred to in the first paragraph are of course those already familiar to Washington from February dispatches.

The following naive comment adds to the attractiveness of the letter: "The Committee for Combating the Counter Revolution states that these circulars were sent from the Don, and the stenographic report was seized in transmission from Kieff. Its origin is undoubtedly Austrian or from the Rada.—M. Skripnik."

Have photograph of letter.

CHAPTER III.

THE GERMAN-BOLSHEVIK PLOT AGAINST THE ALLIES

The following documents, with Mr. Sisson's interpretative notes, expose the German-Bolshevik plot against the Allies.

DOCUMENT NO. 16

Counter Espionage at Army Headquarters, No. 215.

January 21, 1918.

To the Commissariat of Foreign Affairs:

We hereby advise you of the arrival in Mogilev of the following German officers, who are being ordered to England, France, and America:

Zanwald, von Weine, Pabst, Mayer, Gruenwaldt, and Baron Schilling. They have been granted passports, sent here by Commissar Trotsky.

Von Weine, with a Danish passport in the name of Hansen, a merchant of Copenhagen, is to proceed to England.

Baron Schilling is ordered to the United States of America with a Norwegian passport in the name of Dr. Joseph Brun.

Gruenwaldt has instructions to proceed to France with a Russian passport in the name of the Lett, Ivan Kalnin.

The remaining persons are to make a journey through Finland and Sweden, supplied with papers from the German staff, in order to follow up the counter revolutionary work of countries allied to us.

Chief of Counter Espionage:
Feierabend.
Commissar: Vuznetorff.

Note.—*A young German who said he was a deserting officer and that his name was Mayer, sought the aid of the Embassy, the military mission, and myself in getting to America. He was a good-looking young Prussian, had lived in New York, spoke English with very little accent, and claimed to have been converted to the President's views on peace requisites. He said he had walked across the lines as a deserter because he could stand no more of German war, and that he wanted to go to the United States to talk and write against Germany. I was not receptive. He said he was a lieutenant. There is no record at our military control office in Christiania of a passport to Dr. Joseph Brun.*

Have photograph of letter.

DOCUMENT NO. 17

Commissar for Combating the Counter Revolution and Pogroms, No. 32.
Petrograd.

January 5, 1918.

To the People's Commissariat for Foreign Affairs:

The plenipotentiary Commissar for Combating the Counter Revolution, Comrade Antonoff, requests the commissariat for foreign affairs to issue passports for going to Denmark to the following comrades, who are going to the allied countries to conduct peace propaganda:

To England are going: Comrades Adolf Pavlovich Ribba, Ilia Julievich Uritski, Vladislav Antonovich Dashkevich.

To France: Rimma Lvovna Orlova, Vladimir Konstantinovich Schneur.

To America: Isai Borisovich Kahn, Mark Vlasievich Gritsker, Sofia Arturovna Mack.

All the named comrades will visit at Copenhagen the premises of the staff, where they will receive neutral passports for the trip to the named countries. At the disposal of the dispatched will be placed the necessary means for combating in the press with the imperialists of England, France, and the United States. Their confidential addresses will be transmitted to you later on the arrival of the named comrades at the places of their destination.

Authorized commissars:
A. Shilinski.
F. Zubert.

Note.—*Trotsky indorsed this note: "To be urgently executed. L. T."*

The plan of peace propaganda campaign in the allied countries is plainly outlined. These Bolshevik-German agents will preach international Bolshevism and will charge the countries at war with Germany with the very imperialistic offenses of which Germany is guilty. This also was the method used in Russia by the Bolshevik-German press in attacking the United States, England, and France. In the formula of the propaganda, imperialism relates not only to territory but to business enterprise. The agents listed above likely sought entrance under different names. They and the centers from which they work should be recognized, however, by their words and their works. The commissars who sign are members of the commission for Combating the Counter Revolution.

Have photograph of letter.

DOCUMENT NO. 18

G[reat] General Staff, Central Division,
Section M, No. 951.

December 20, 1917.

To the Commissariat of Foreign Affairs:

According to the negotiations between the Russian and German peace delegations at Brest-Litovsk, the Russian Division of the German General Staff have the honor to request the hastening of the departure of agitators to the camps of Russian prisoners of war in Germany, for the recruiting of volunteers who will be sent to the English and French troops for the purpose of observation and peace propaganda.

Simultaneously, the staff requests the following sailors to be sent to Germany: Shishko, Kirshu, Matviev, and Dratchuk. They will receive special instructions when traveling through Brest-Litovsk.

Chief of the Russian Division, German General Staff: O. Rausch.
Adjutant: U. Wolff.

Note.—*This request was referred to the Commissariats on Military and Naval Affairs.*

A marginal question asked by E. P. (probably Polivanoff): "[Is] Dratchuk at Black Sea?" He was at Sevastopol and may not have been sent. The others went, visited the camps for war prisoners in Germany, and then returned to Russia. Shishko in February was Commissar of the Naval College in Petrograd.

Have photograph of letter.

DOCUMENT NO. 19

Counter Espionage at Army Headquarters,
No. —.

January 16, 1918.

To the Council of People's Commissars:

I hereby bring to the notice of the Council of People's Commissaries that through our front, on the personal permission of the Supreme Commander, have passed 100 German officers, 250 non-commissioned officers, who proceeded to our internal fronts; part of the German officers have gone to the front in the Don region, part to the front against Dutoff, and part to Eastern Siberia and the Trans-Baikal for the surveillance, and if it shall be possible, to oppose the Japanese occupational detachment and the counter revolutionary Trans-Baikal Cossack officers.

Counter Espionage Official:
P. Arkhipov.

Note.—*An odd comment gives interest to this letter. It is this: "An accusation or a silly accusal for personal benefit? Communicate [to] Comrade Krilenko," signed "N. G."*

Have photograph of letter.

DOCUMENT NO. 20

Counter Espionage at Army Headquarters,
No. 52.

Jan. 8, 1918.

To the Council of People's Commissars:

The Supreme Commander Krilenko has received an offer from the Supreme Commander of the German army to send to the disposal of the German staff ten reliable officers of the revolutionary army. The said persons must arrive at Warsaw, where they will receive their further instructions. The aim of the trip is to visit the camps of our prisoners of war on the propaganda of peace ideas. The staff points out the desirability of sending Dzevaltovsky, Simashko, Saharoff, and Volodarsky.

For the Chief of the Counter Espionage: S. Kalmanovich.
For the Commissar: Alexieff.

Note.—*Dzevaltovsky was an officer of the Life Guards Grenadier Regiment, and an agitator who aroused the soldiers at the time of the ill-fated June advance. Volodarsky has been referred to previously. He was assassinated in late June at Moscow. Kalmanovich was a Commissar on the staff of Krilenko, the talking man who was assigned to disorganize the army. In actual army rank Krilenko was a sublieutenant.*

Have photograph of letter.

DOCUMENT NO. 21

Gr. General Staff, Central Division, Section M, No. 750.

Berlin, November 1, 1917.

To the Council of People's Commissars:

In accordance with an inquiry from the German General Headquarters, I have the honor to request you to inform me at the earliest possible moment the exact quantity of ammunition at the following places: Petrograd, Archangel, Kazan, Tiflis.

It is necessary also to state the quantity and storage place of the supplies which have been received from America, England, and France, and also the units which are keeping guard over the military stores.

Head of Division: O. Rausch.
Adjutant: U. Wolff.

Note.—*This is a request made upon a country which America, England, and France still regarded at that date as an ally.*

Have photograph of letter.

DOCUMENT NO. 22

G[eneral] S[taff] of the High Sea Fleet,
No. 79.
Jan. 10, 1918.
(Very Secret)

To the Council of People's Commissars:

The Petersburg representative of the Supreme Sea Command has received by wireless from Kiel orders to propose to the Council of People's Commissars to place at the disposal of our agents at Vladivostok—Buttenhof, Staufacher, and Franz Walden—several steamships. On these ships must be loaded the goods indicated by our named agents and also persons indicated by them, and be sent as directed to ports of the United States, Japan, and British colonies in Eastern Asia. In case of absence of free tonnage in Pacific ports, it is necessary to charter ships sailing under a foreign flag. The object of sending the ships is to carry to enemy countries agents-agitators, and agents-destructors. All the expenses and risk the Petrograd agency of the Supreme Naval Command takes for account of the naval operations fund.

Capt. Lieut. Rudolph Miller.

Note.—*The indorsement of Lenin's secretary Skripnik is: "Reported." The active Vladivostok agents have been referred to previously. The threat of the arrival of German agents through Pacific ports is apparent.*
Have photograph of letter.

DOCUMENT NO. 23

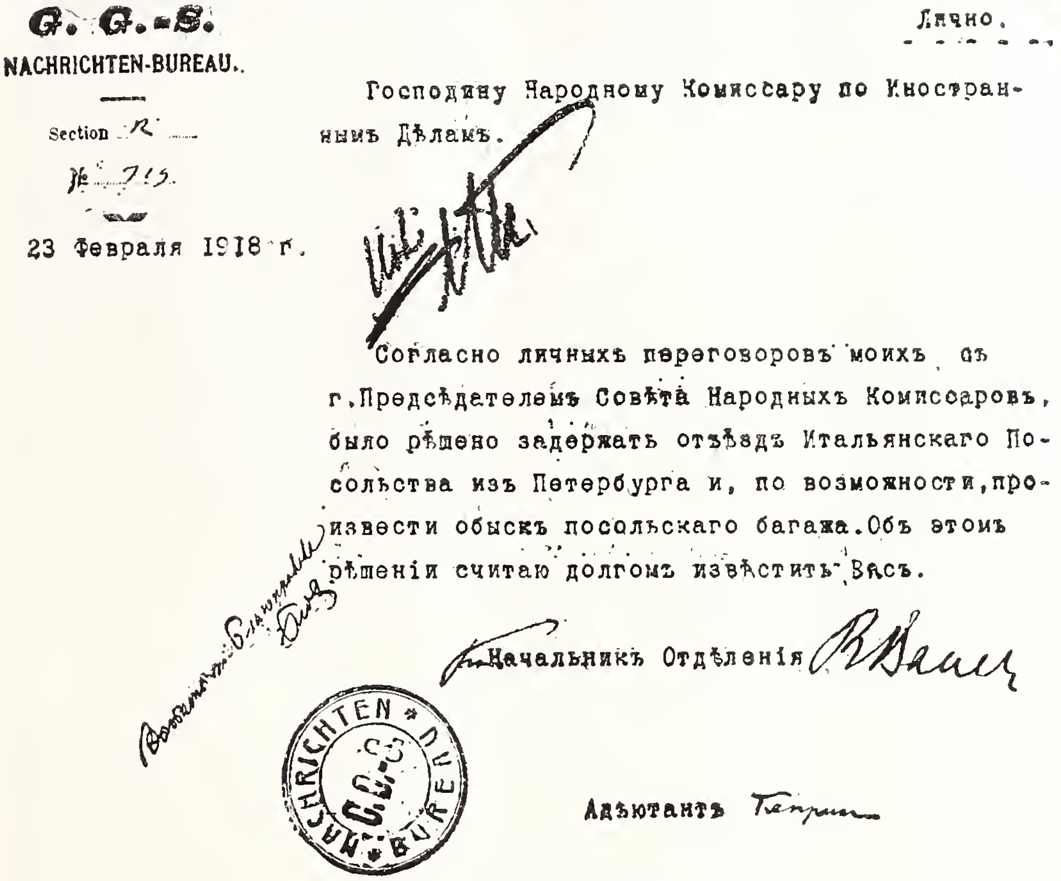
G[eneral] S[taff] of the High Sea Fleet,
No. 85.
Jan. 14, 1918.
(Very Secret)

To the Council of People's Commissars:

According to instructions of the German High Sea Command, transmitted to-day to me by radio A, I apply to the Russian Government with a proposal to take measures to deliver to the Pacific by railway three of our submarines, disassembled. On the conclusion of peace negotiations and the conclusion of peace between Russia and Germany this transporting must be begun immediately, whereby on the conclusion of the war the transported vessels will remain at the disposal of the Russian Government.

Capt. Lieut.: Rud. Miller.

Note.—*The letter is indorsed: "Reported. Secretary Skripnik." The transporting, according to the categorical demand, was to begin immediately after peace was signed. These are the only two communications of Capt. Miller that appear.*
Have photograph of letter.



G. G.-S.
NACHRICHTEN-BUREAU.
Section R
№ 715.
23 Февраля 1918 г.

Лично.

Господину Народному Комиссару по Иностраннымъ Дѣламъ.

Согласно личныхъ переговоровъ моихъ съ г. Предсѣдателемъ Совѣта Народныхъ Комиссаровъ, было рѣшено задержать отъѣздъ Итальянскаго Посольства изъ Петербурга и, по возможности, произвести обыскъ посольскаго багажа. Объ этомъ рѣшеніи считаю долгомъ извѣстить Васъ.

Начальникъ Отдѣленія R. Bauer

Адъютантъ

Facsimile Document Number 26

DOCUMENT NO. 24

Commissar for Combating the Counter Revolution and Progroms, No. 445/63.
Petrograd, Jan. 21, 1918.

To the Commissar of War, Sklianský:

Our agency on the Furhstatskaya informs us that two people not seen before have been noticed to visit the American Embassy three times.

Maj. Luberts begs to point out to Commissioner Podvoisky the necessity of keeping a watch over the movements of these two persons. I ask your instructions.

Commissar: A. Kozmin.

Note.—*Maj. Luberts believed in identifying visitors to the American Embassy. Podvoisky was the Minister of War.*
Have photograph of letter.

DOCUMENT NO. 25

G. G.-S., Intelligence Bureau, Section R,
No. 168.
Dec. 17, 1917.
(Very Secret)

To the Commissar on Foreign Affairs:

At the request of the Commission on Combating the Counter Revolution of December 17, the Intelligence Bureau has the honor to forward a list of men watching the missions of the countries allied to Russia:

The British Embassy is watched by German scouts Luze, Telman, Possel, Franz, and Gezel; Russian agents Ovisannikov, Gluschenko, and Baliasin.

The French Embassy is watched by German scouts Silvester, Butz, Folhagen; Russian agents Balashev, Turin, Gavrilov, Sadavnokov, and Shilo.

The U. S. A. Embassy is watched by German scouts Strom, Buchholtz, Fasnacht, Todner; Russian agents Spitzberg, Sokolnizky, Turasov, and Vavilov.

The Roumanian mission is watched by German scouts Suttner, Baider, Wolf; Russian agents Kuhl, Nikitin, Zolotov, and Arkipov.

The Italian Embassy is watched by Austrian scouts Kuhlder, von Geze, Goin, and Burmeister; Russian agents Salov, Alekseievsky, and Kuzmin.

These agents must fulfill all instructions of the Commission for Combating the Counter Revolution, Sabotage, Looting, etc.

Head of Bureau: Agasfer.
Adjutant: E. Rantz.

Note.—*The German Maj. Luberts (Agasfer, see Document No. 5), therefore was the keeper of Ambassadorial hostages of the allied countries in Russia throughout the winter. The names listed above were unidentifiable in the establishments of at least the British and the American Embassies. All may have been outside watchers. The method of outside surveillance is shown in Document No. 27.*
Have photograph of letter.

DOCUMENT NO. 26

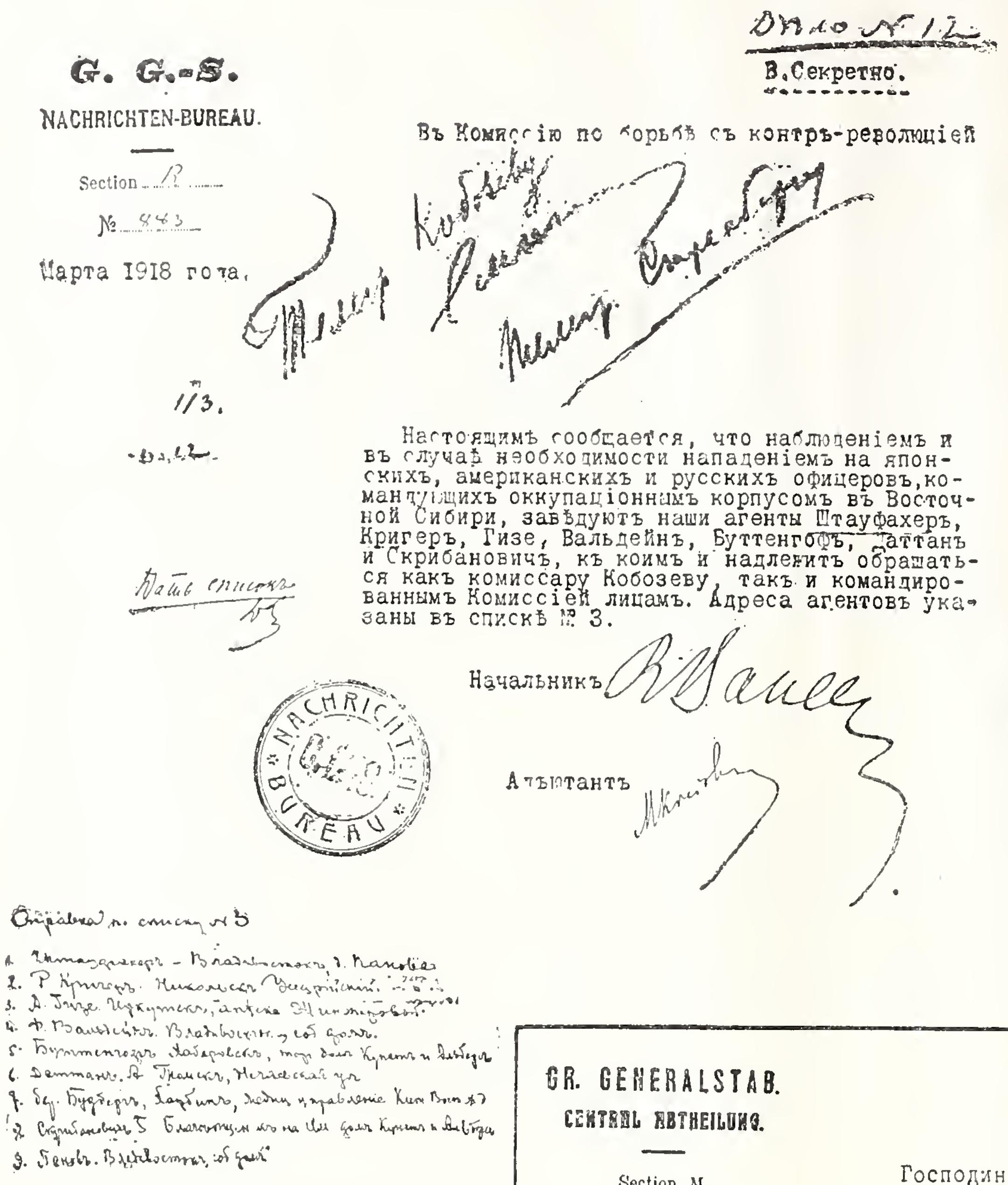
G. G.-S., Intelligence Bureau, Section R,
No. 715.
(Personal)
Feb. 23, 1918.

To the Commissar of Foreign Affairs:

According to my personal conversation with the chairman of the Council of People's Commissars, it has been decided to delay the departure of the Italian Embassy from Petersburg and, as far as possible, to search the Embassy baggage. Of this decision I count it my duty to inform you.

For the head of the Bureau:
R. Bauer.
Adjutant: Henrich.

Note.—*Across the top of letter is written by Trotsky, "Instruct," and signed with the initials, L. T. It is here set forth laconically that a German officer of the General Staff and Lenin in conference ordered the search of the baggage of the ambassador of a country friendly to Russia and at war with Germany; and that Trotsky gave the instructions for carrying out the order. A clerk's note at the bottom is additionally specific: "To be given to Blagonravoff." The last named was the Commissar of Martial Law in Petrograd. The Italian Embassy train was delayed for more than 24 hours when it sought to depart, some days later. Petroff, assistant foreign minister, told me on March 2 with a great show of indignation, that "The Italians had given a diplomatic passport to the embassy cook." So, he said, it was right to search*



Дѣло № 12

В. Секретно.

G. G.-S.

NACHRICHTEN-BUREAU.

Section R

№ 843

Марта 1918 года.

Въ Комиссiю по борьбѣ съ контръ-революцiей

1/3.

Настоящимъ сообщается, что наблюденiемъ и въ случаѣ необходимости нападенiемъ на японскихъ, американскихъ и русскихъ офицеровъ, командующихъ оккупацiоннымъ корпусомъ въ Восточной Сибири, завѣдуютъ наши агенты Штауфахеръ, Кригеръ, Гизе, Вальдейнъ, Буттенгофъ, Даттанъ и Скрибановичъ, къ коимъ и надлежитъ обращаться какъ комиссару Кобозеву, такъ и командированнымъ Комиссiей лицамъ. Адреса агентовъ указаны въ спискѣ № 3.

Дать списокъ

Начальникъ R. Bauer

Адъютантъ

NACHRICHTEN BUREAU

Справка по списку № 3

1. Штауфахеръ – Владивостокъ, [illegible]
2. Р. Кригеръ. Никольскъ Уссурiйскiй [illegible]
3. А. Гизе. Иркутскъ, аптека [illegible]
4. Ф. Вальдейнъ. Владивостокъ, соб. домъ.
5. Буттенгофъ Хабаровскъ, торг. домъ Кунстъ и Альберсъ
6. Даттанъ. А. Томскъ, [illegible] ул.
7. [illegible] Буддбергъ, Харбинъ, [illegible] управленiе Кит. Вост. ж. д.
8. Скрибановичъ Б. Благовѣщенскъ [illegible] домъ Кунстъ и Альберсъ
9. [illegible] Владивостокъ, соб. домъ

Facsimile Document Number 29

the train. If they had better luck than they did when they held up and searched the Italian ambassador in his automobile almost in front of the Hotel Europe, I did not hear of it. Document 27 tells of that robbery.

Have original letter, No. 26.

DOCUMENT NO. 27

Commissar on Combating the Counter Revolution and Pogroms, No. 71.

Petrograd, Feb. 24, 1918.

(Specially Secret—Personal)

To the People's Commissar on Foreign Affairs:

Our agents investigating the Italian Embassy, I. E. Macrov, Imenitski, and Urov, followed up the ambassador and conducted a search of him in the street, with a confiscation. Documents regarding relations with German diplomats and the special papers of the ambassador to the allied ambassadors, mentioned by you, were not found. In order to mask the attack several articles listed in the protocol furnished by Comrade Imenitski were taken from the ambassador.

The watch on the British and American ambassadors and the Serbian minister has been intensified. The supplementary observation point on the British Embassy has been established in the Marble Palace—Lieut. Bekker and a member of the central executive committee of the Council of Workmen's and Soldiers' Deputies, Frunze.

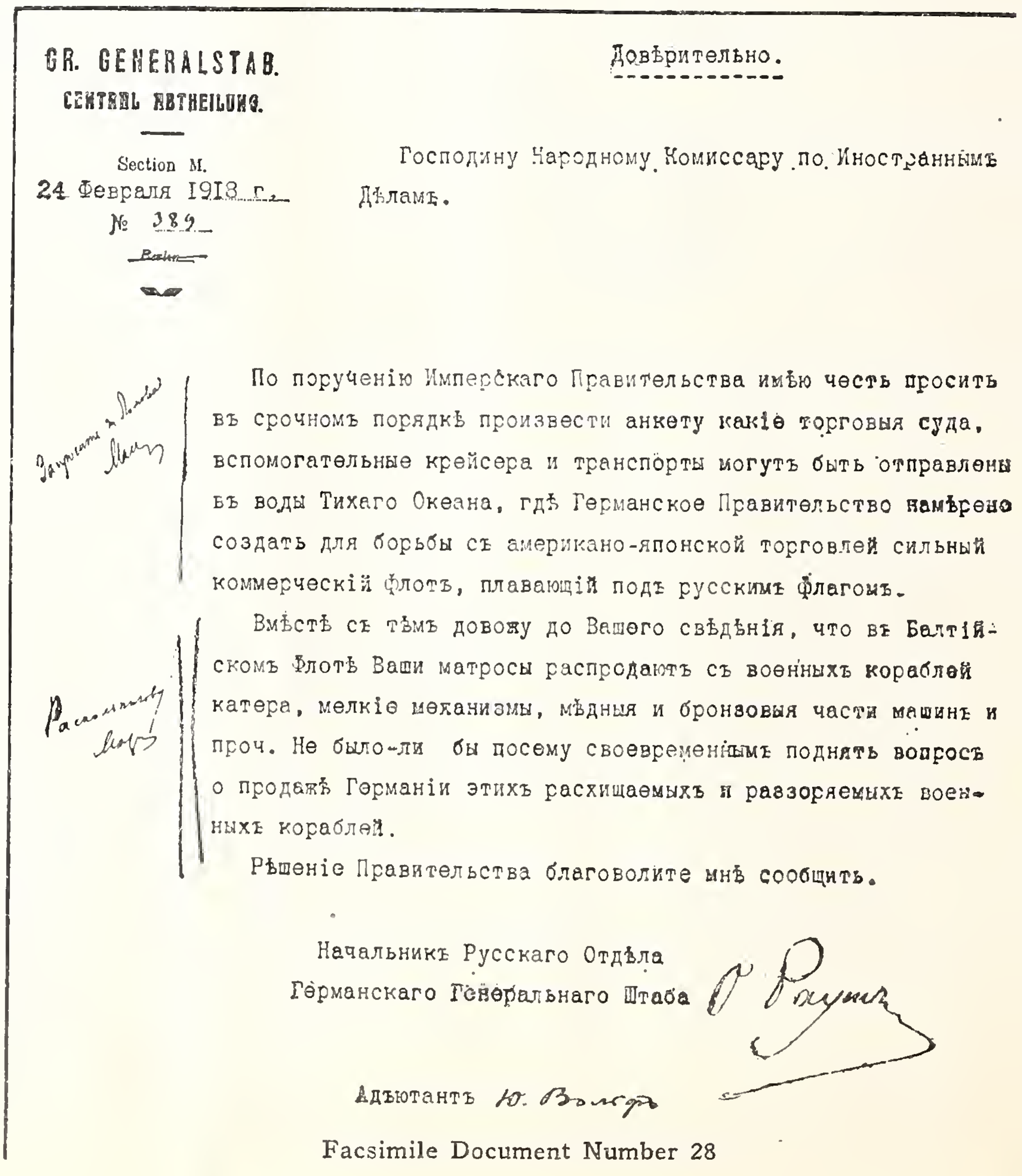
On the French Embassy, on the French Quay, house No. 8, Comrade Peters, member of the central executive committee of the council of Workmen's and Soldiers' Deputies, supplementary.

On the North American Embassy observation has been established at Furhstatskaya Street, house No. 23, apartments Nos. 1 and 4. In the latter Comrades Goldberg and Spitzberg are carrying on the observation very successfully. Telephones have been installed in the above-mentioned places. General management of the surveillance has been intrusted to Alfred von Geigendorf.

Commissar: Mitopovich.
For Secretary: R. Baetski.

Note.—*Most of the names in this letter, including the signatures at end, are unfamiliar. Peters, placed in charge of French observation, is a Lettish sailor, active and able, a former resident of England. The robbery of the Italian ambassador took place late in the evening on a lighted frequented central street and was a day's sensation. The observation point on the American Embassy was a yellow apartment house almost opposite the entrance. After I got this information I tested the watch and always saw a head or hand retreating from a window. But I doubt if the watchers profited much by studying the visitors to the embassy.*

Have photograph of letter.



GR. GENERALSTAB.
CENTRAL ABTHEILUNG.

Section M.
24 Февраля 1918 г.
№ 389
Berlin

Довѣрительно.

Господину Народному Комиссару по Иностраннымъ Дѣламъ.

По порученiю Имперскаго Правительства имѣю честь просить въ срочномъ порядкѣ произвести анкету какiе торговыя суда, вспомогательные крейсера и транспорты могутъ быть отправлены въ воды Тихаго Океана, гдѣ Германское Правительство намѣрено создать для борьбы съ американо-японской торговлей сильный коммерческiй флотъ, плавающiй подъ русскимъ флагомъ.

Вмѣстѣ съ тѣмъ довожу до Вашего свѣдѣнiя, что въ Балтiйскомъ Флотѣ Ваши матросы распродаютъ съ военныхъ кораблей катера, мелкiе механизмы, мѣдныя и бронзовыя части машинъ и проч. Не было-ли бы посему своевременнымъ поднять вопросъ о продажѣ Германiи этихъ расхищаемыхъ и раззоряемыхъ военныхъ кораблей.

Рѣшенiе Правительства благоволите мнѣ сообщить.

Начальникъ Русскаго Отдѣла
Германскаго Генеральнаго Штаба R. Bauer

Адъютантъ Ю. Вольфъ

Facsimile Document Number 28

DOCUMENT NO. 28

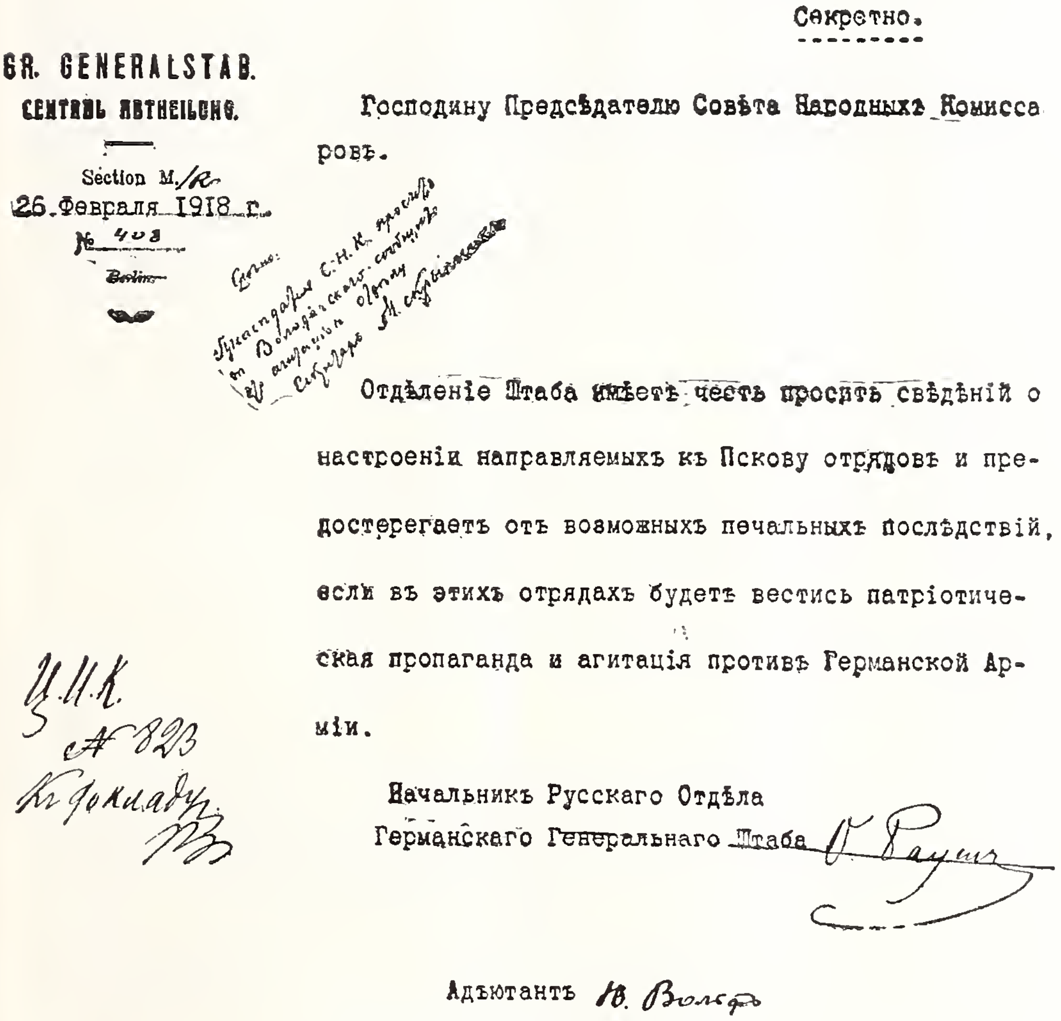
Gr. General Staff, Central Division, Section M, No. 389.

(*Confidential*)

February 24, 1918.

To the People's Commissar of Foreign Affairs:

According to instructions of the Imperial Government, I have the honor to ask you to make in the shortest possible time an investigation as to what commercial boats, auxiliary cruisers, and transports may be sent into the waters of the Pacific Ocean, where the German Government intends to form, for the purpose of opposing the American-Japanese trade, a powerful commercial fleet flying the Russian flag.



Секретно.

GR. GENERALSTAB.
CENTRAL ABTHEILUNG.

Section M./R.
26 Февраля 1918 г.
№ 403
~~Berlin~~

Срочно: Председателю С.Н.К. просьба от Вологодского [illegible] [illegible] Секретарь [illegible]

Господину Председателю Совѣта Народныхъ Комиссаровъ.

Отдѣленіе Штаба имѣетъ честь просить свѣдѣній о настроеніи направляемыхъ къ Пскову отрядовъ и предостерегаетъ отъ возможныхъ печальныхъ послѣдствій, если въ этихъ отрядахъ будетъ вестись патріотическая пропаганда и агитація противъ Германской Арміи.

Ц.И.К.
№ 823
Къ докладу

Начальникъ Русскаго Отдѣла
Германскаго Генеральнаго Штаба О. Раушъ

Адъютантъ Ю. Вольфъ

Facsimile Document Number 30

At the same time I call to your attention the data that in your Baltic fleet your sailors are selling from the war ships the launches, small fittings, copper, and bronze parts of machines, etc. Would it not be the proper time to raise the question of selling to Germany these war vessels which are being stripped and disarmed?

Be so kind as to communicate the decision of the Government.

Head of the Russian Division of the German General Staff: O. Rausch.
Adjutant: U. Wolff.

Note.—*Opposite first paragraph is the notation: "Ask Lomof. Markin." Latter was one of Trotsky's secretaries. Opposite paragraph second, Markin makes notation, "Refer to Raskolnikoff." Latter is a commissar on this Naval General Staff, who conducted conferences with German officers in Kronstadt in March, April, and July, 1917, and an active aid to Dybenko in stirring up the Russian fleet to revolt. Do not know who Lomof is. The importance of the first paragraph as indicating the use against America to which Germany intends to put Russia is self-evident. The ludicrous picture painted in the second paragraph at once intensifies the shame of the ending of the fine new Russian Navy and discloses the German hope of securing and refitting the vessels.*

Have original letter.

DOCUMENT NO. 29

G. G.-S., Intelligence Bureau, Section R, No. 883.

(*Very Secret*)

March 9, 1918.

To the Commission for Combating the Counter Revolution:

It is herewith communicated that for watching, and if necessary attacking, the Japanese, American, and Russian officers who may command the expeditionary forces in eastern Siberia, our agents Staufacher, Krieger, Geze, Walden, Buttenhoff, Dattan, and Skribanovich take charge, and to whom it is necessary that either Commissar Kobozeff or any of those named by the commission must apply. The addresses of the agents are shown in list No. 3

Head: R. Bauer.
Adjutant: M. K——.(?)

Note.—*Comments to "Telegraph Kobozeff" and "Telegraph Streaberg," with an illegible signature, appear on letter, and below it is the order: "Give the list," initialed "D. Z.," corresponding with the signing habit of Dzerzhinski, chairman of the Commission for Combating the Counter Revolution. Below this order appears the list of addresses, as follows.*

Report according to list No. 3.

1. Staufacher Vladivostok, Panoff's house.
2. R. Krieger, Nikolsk, Ussurisky.
3. A. Geze, Irkutsk, drug store, Zhinzheroff.
4. F. Walden, Vladivostok, his own house.
5. Buttenhoff, Khabarovsk, firm Kunst & Albers.
6. Dattan, Tomsk, Nechayevskaya Street (Initial A.)
7. [Brothers or Baron] Kuzberg, Harbin, offices of the Chinese-Eastern Railway.
8. Skribanovich (initial G.), Blagoveschensk, house of Kunst & Albers.
9. Panoff, Vladivostok, his own house.

This letter was sent me after I left Petrograd and reached me April 5. It is important not only for content, indicating as it does the names and addresses of agents-destructors who are called upon for increasing activity against the United States and Japan to make the Pacific Ocean a new area of terror, but showing that the German General Staff was continuing after the Brest-Litovsk "peace" to work actively with the Russian Bolshevik Government.

Have original letter.

CHAPTER IV.

THE PLOT FOR A SHAMEFUL PEACE

Germany made its Russian peace with its own puppet government, the misnamed Council of People's Commissars, the president of which is Vladimir Ulianov (Lenin), the foreign minister of which was Leon Trotsky, and the ambassador of which to Germany is A. Joffe. Germany made this peace harder upon the Russian people as punishment to the ambition of its tools in seeking to become too powerful, and in hoping for a little while not only that Russia would be delivered over to them, but that they could double-cross their masters by turning a simulated German revolution into a real one.

But their craftiness was a toy in the hands of rough German force. Germany was actually double-crossing them by negotiating with the Ukranian Rada at the moment they dreamed they were tricking Germany.

Germany, however, did not discard the Bolshevik leaders, recognizing their further use in the German world campaign for internal disorganizations in the nations with which it wars, but confined them to the limited inland province which Great Russia proper has now become.

Lenin, according to statements made public as soon as Trotsky's spectacular device of "No peace—No war" failed, always was for peace on any German terms. He dominated the situation thereafter and conceded everything that Germany asked. Nor did Trotsky cease to continue to obey the German orders delivered to him both by Gen. Hoffman at Brest-Litovsk, and at Petrograd directly by the Russian Division of the German General Staff, which was seated in Petrograd itself from November, 1917, and which was still there in full operation when I left, Monday, March 4, the day that Petrograd received notification that peace had been signed at Brest-Litovsk by the Russian and German delegations.

Trotsky, therefore, rests rightly under the accusation of having staged his theatrical scene as a climax to the Russian disorganization desired by Germany. The actual order he gave was for the immediate demobilization of the Russian army, leaving the German army unopposed.

The actual effect of the work of the Bolshevik leaders, moreover, was to enable Germany to combine its former army of the Russian front with its western army, for the launching of its March offensive in France. Such has been the fruition of Russia's German-directed Bolshevikism.

The following documents tell the story of the betrayal of Russia to a shameful and ruinous peace.

DOCUMENT NO. 30

G[reat] General Staff, Central Division Section M/R, No. 408.

(Secret)

February 26, 1918.

To the Chairman of the Council of People's Commissars:

This Division of the Staff has the honor to request data of the attitude of the detachments being sent to Pskoff and to guard against all possible disastrous results if in these detachments any will carry on patriotic propaganda and agitations against the German army.

Head of the Russian Division German General Staff: O. Rausch.
Adjutant: U. Wolff.

Note.—*The chairman of the Council of People's Commissars is Lenin. At the top of this letter is the written comment: "Urgent. Chairman of the Council of People's Commissars asks Volodarsky to communicate this to the agitation department. Secretary Skripnik." Skripnik is the first secretary of the Government, personally reporting to Lenin. A second notation in margin is: "Central Executive Committee No. 823 to report," signed with illegible initials. The detachments being sent to Pskoff at this time were composed of Red Guards and of the recruits of the new Red Army. Pskoff was taken by the Germans without a fight.*

Have original letter.

DOCUMENT NO. 31

G. G.-S., Intelligence Bureau, Section R, No. 750.

(Very Secret)

February 27, 1918.

To the President of the Council of People's Commissars:

Not having received an exact answer to my question of the 25th of February, I now have the honor a second time to request you to inform me in the shortest possible time the numbers and kind of forces sent to Pskoff and Narva.

At the same time, at the orders of the representative of our General Staff, I once more remind you of the desirability of naming Gen. Parski to the post of commander in chief of the Russian armed forces, in place of Gen. Bonch-Bruevich, whose actions do not meet the approval of the German High Command. Since the attacks on the lives and property of the German landowners in Esthonia and Livonia, which, according to our information, were carried out with the knowledge of Gen. Bonch-Bruevich, and his nationalistic actions in Orel, his continuance in the position of general is no longer desirable.

Head of the Bureau:
Agasfer.

Note.—*Across the letter is written "Send to Trotsky and Podvoisky. N. G." (Gorbunov's initials, chief secretary of the Council of People's Commissars.) Observe the mandatory nature of the whole letter and particularly of the first paragraph. Agasfer, as has been shown, is the cipher signature of Maj. Luberts, head of the Petrograd Intelligence Bureau of the German General Staff, the chief branch of the Russian Division of the German General Staff, the head of which is Maj. Rausch, referred to in this letter as the representative of "our General Staff." Apparently both Luberts and Rausch wrote a warning against sending any patriots to the defending forces, and seemingly the Bolshevik effort at obedience as indicated in document No. 30 was not fast enough to suit the German martinets. Podvoisky was minister of war. Gen. Parski was appointed to the command of the Petrograd district, and as late as June 14 still held the post. He formerly was in command of the city of Riga, which was surrendered to the Germans without adequate defense in the early autumn of 1917.*

Have original letter.

DOCUMENT NO. 32

G. G.-S., Intelligence Bureau, Section R, No. 272/600.

(Very Secret)

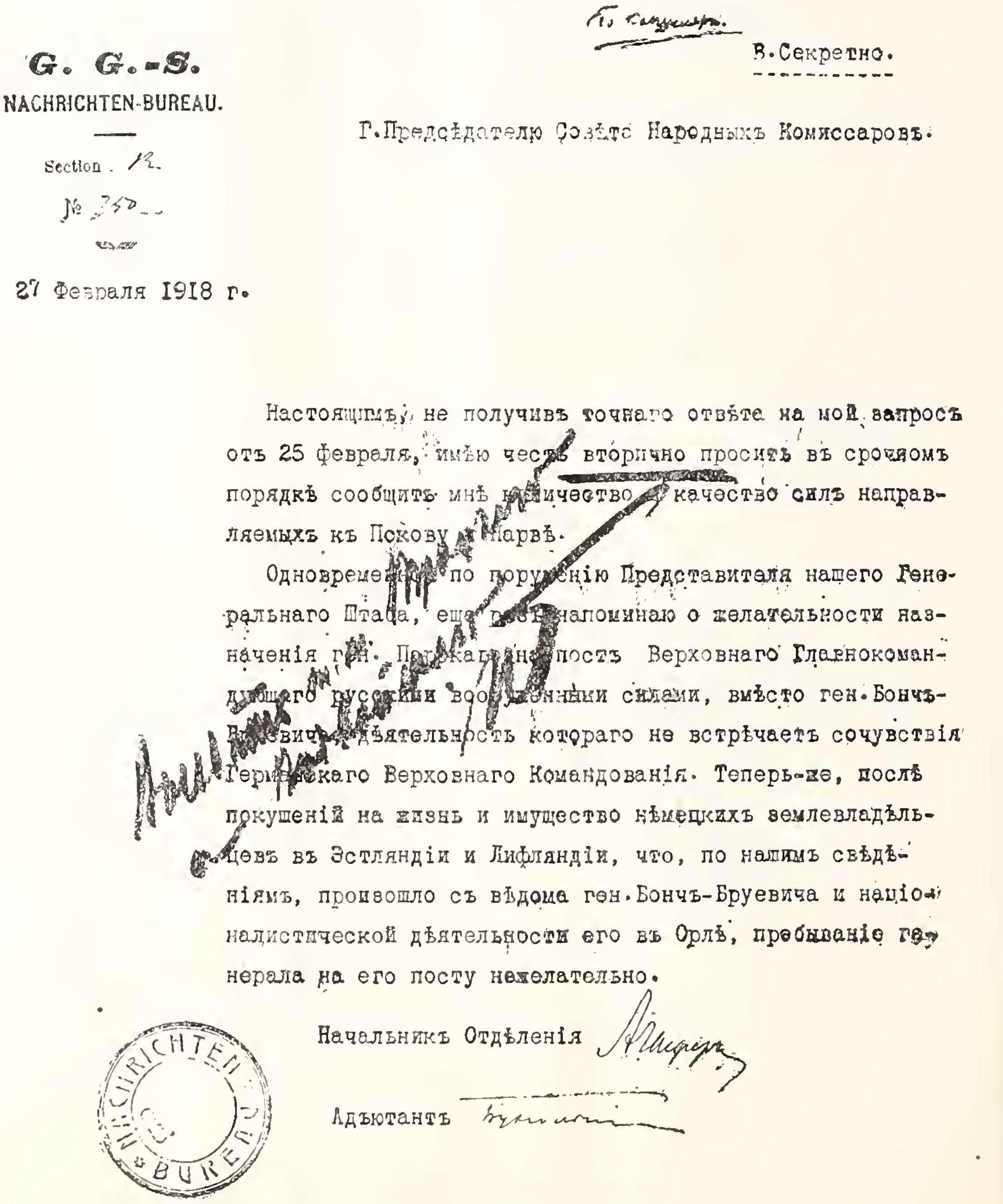
February 6, 1918.

To the People's Commissar of Foreign Affairs:

I ask you to immediately give the Turkish subject, Carp C. Missirof, a Russian passport in place of the one taken from him, which was given him in 1912 on the basis of the inclosed national passport.

Agent C. Missirof is to be sent to the staff of the Russian High Command, where, according to the previous discussion between Gen. Hoffman and Commissars Trotsky and Joffe, he will keep watch on the activity of the head of the staff, Gen. Bonch-Bruevich, in the capacity of assistant to the Commissars Kalmanovich and Feierabend.

For the head of the Bureau:
R. Bauer.
Adjutant: Bukholm.



G. G.-S.
NACHRICHTEN-BUREAU.

Section . R.
№ 750

27 Февраля 1918 г.

В.Секретно.

Г.Предсѣдателю Совѣта Народныхъ Комиссаровъ.

Настоящимъ, не получивъ точнаго отвѣта на мой запросъ отъ 25 февраля, имѣю честь вторично просить въ срочномъ порядкѣ сообщить мнѣ количество и качество силъ направляемыхъ къ Пскову и Нарвѣ.

Одновременно по порученію Представителя нашего Генеральнаго Штаба, еще разъ напоминаю о желательности назначенія ген. Парскаго на постъ Верховнаго Главнокомандующаго русскими вооруженными силами, вмѣсто ген. Бончъ-Бруевича, дѣятельность котораго не встрѣчаетъ сочувствія Германскаго Верховнаго Командованія. Теперь-же, послѣ покушеній на жизнь и имущество нѣмецкихъ землевладѣльцевъ въ Эстляндіи и Лифляндіи, что, по нашимъ свѣдѣніямъ, произошло съ вѣдома ген. Бончъ-Бруевича и націоналистической дѣятельности его въ Орлѣ, пребываніе генерала на его посту нежелательно.

Начальникъ Отдѣленія

Адъютантъ

Facsimile Document Number 31

NOTE.—*Here we have the behind-the-scene disclosure of the real relations between Trotsky and Gen. Hoffman at Brest-Litovsk, stripping the mask from the public pose. Trotsky got his orders in this case and he carried them out. Across the top of this letter, too, he has written his own conviction, "Ask Joffe. L. T.," while Joffe, whose rôle seems to be that of the mouthpiece of Germany, has written in the margin, "According to agreement this must be done. A. Joffe." Thereby he becomes a witness for the agreement itself—that pledge between himself, Trotsky, and the military chief of the German Government at the Brest-Litovsk conference, to betray the commander of the Russian army when he should attempt to defend Russia against Germany. A further marginal note states that the passport was given February 7, under the Russian name, P. L. Ilin.*

Have original letter and the surrendered passport. Kalmanovich and Feierabend were Commissars of Counter Espionage.

THE UKRAINIAN DOUBLE-CROSS

How the Bolsheviki themselves were double-crossed in the Ukraine; how the Germans toyed with their puppets to disorganize Russia, with disclosures of plans for assassination of loyal Russian leaders, are shown in the following documents and Mr. Sisson's accompanying notes.

DOCUMENT NO. 33

Counter Espionage at Army Headquarters,
No. 63.

January 10, 1918.

TO THE COMMISSION FOR COMBATING THE COUNTER REVOLUTION:

The Commissar on Combating the Counter Revolution in a cipher telegram, No. 235, demanded the sending of special agents to Kieff and Novocherkask.

There have been sent Comrades Vlasenko, Gavrilchuk, and Korablev, who have more than once very successfully performed information service. The commissar in his cipher telegram indicates that the German and Austrian agents assigned from Petrograd, Lieuts. Otto, Kremer, Blum, and Vasilko, are playing a double rôle, reporting on what is happening at Petrograd, and they carry on an intensive agitation in favor of a separate peace of the Ukraine with the Central Powers, and for the restoring of order. Their work is having success.

To Siberia have been ordered Comrades Trefilev and Shepshelevich, in connection with your report of the purchase and export of gold by Austrian prisoners in Siberia.

Director of Counter Espionage:
FEIERABEND.
Secretary: N. DRACHEFF.

NOTE.—*So stands disclosed the manner in which Germany set about to double-cross the Bolshevik servants who in success had become at times uppish in bargaining with their masters. It was not a part of the German program to create in Russia a power which it could not at any time control, or, if need be, overturn. Its plan here had the additional advantage of not only disciplining the Petrograd Bolsheviks but also of disunifying Russia still further. It worked out to a separate peace with Ukraine and a separate peace with Great Russia. Lieut. Otto is the Konshin afterwards arrested for some unknown betrayal. See Document No. 2.*

Have photograph of letter.

DOCUMENT NO. 34

Counter Espionage at Army Headquarters,
No. 511.

January 30, 1918.

TO THE COMMISSION FOR COMBATING COUNTER REVOLUTION:

You are informed that the German and Austrian officers located at Kieff now have private meetings with members of the deposed Rada. They insistently inform us of the inevitable signing and ratification of peace treaties both between the Ukraine and the Central Powers and between Roumania and Austria and Germany.

Director of Counter Espionage:
FEIERABEND.
Commissar: O. KALMANOVICH.

NOTE.—*Corroborative of the preceding document. The separate peace with the Ukraine already had been signed.*

Have photograph of letter.

DOCUMENT NO. 35

G. G.-S. Intelligence Bureau, Section R,
No. 181.

(*Very Urgent*)

December 9, 1917.

TO THE PEOPLE'S COMMISSAR OF FOREIGN AFFAIRS:

In accordance with your request, the Intelligence Bureau on November 29 sent to Rostof Maj. von Boehlke, who arranged there a survey over the forces of the Don Troop Government. The major also organized a detachment of prisoners of war, who took part in the battles. In this case, the prisoners of war, in accordance with the directions given by the July conference at Kronstadt, participated in by Messrs. Lenin, Zinovieff, Kameneff, Raskolnikoff, Dybenko, Shisko, Antonoff, Krilenko, Volodarsky, and Podvoisky, were dressed in Russian army and navy uniforms. Maj. von Boehlke took part in commanding, but the conflicting orders of the official commander Arnautoff, and the talentless activity of the scout Tulak, paralyzed the plans of our officer.

The agents sent by order from Petrograd to kill Gens. Kaledin, Bogaevsky, and Alexieff were cowardly and nonenterprising people. Agents passed through to Karauloff. The communications of Gen. Kaledin with the Americans and English are beyond doubt, but they limit themselves entirely to financial assistance. Maj. von Boehlke, with the passport of the Finn, Uno Muuri, returned to Petrograd and will make a report today at the office of the chairman of the council at 10 p. m.

For the head of the Bureau:
R. BAUER.
Adjutant: M. K.——(?).

NOTE.—*This is a cold-blooded disclosure of a German-Bolshevik plan for the assassination of Kaledin and Alexieff, as well as proof of a condition often denied by Smolny during the winter—that German prisoners were being armed as Russian soldiers in the struggle against the Russian nationalists on the Don. The letter also contains the most complete list of the participants in the July conspiracy conference at Kronstadt. The marginal comment opposite the assassination paragraph, "Who sent them?" is in an unknown handwriting. Maj. von Boehlke is a German officer referred to in Document No. 5. His cipher signature is Schott.*

Have photograph of letter.

DOCUMENT NO. 36

G. G.-S., Intelligence Bureau, Section R,
No. 136.

(*Very Secret*)

November 28, 1917.

TO THE COUNCIL OF PEOPLE'S COMMISSARS:

In accordance with your request, the Intelligence Bureau of the General Staff informs the Council of People's Commissars that the Ukrainian Commission at the Austrian High Command, in which participate the empowered representatives of the German Staff, has worked out a plan of the activities of the revolutionaries known to the Council of People's Commissars and the Central Executive Committee of the Council of Workmen's and Soldiers' Deputies—Chudovsky, Boyarsky, Gubarsky, and Piatakov—who are under the full direction of the Austro-Hungarian High Command.

The commander in chief of the Russian army has been made acquainted by Schott with plans of the Austro-German High Command and will cooperate with him.

Head of Bureau: AGASFER.

NOTE.—*At this early time there was harmony all around on the Ukraine program, Germans, Austrians, and the Commissars in complete brotherhood. Schott is Maj. von Boehlke and Agasfer is Maj. Luberts.*

Have photograph of letter.

CHAPTER V.

TROTSKY AND ROUMANIA

The machinations of Trotsky, inspired by the German Gen. Hoffman, for the disruption of Roumania are disclosed in the following:

DOCUMENT NO. 37

Counter Espionage at Army Headquarters,
No. 20.

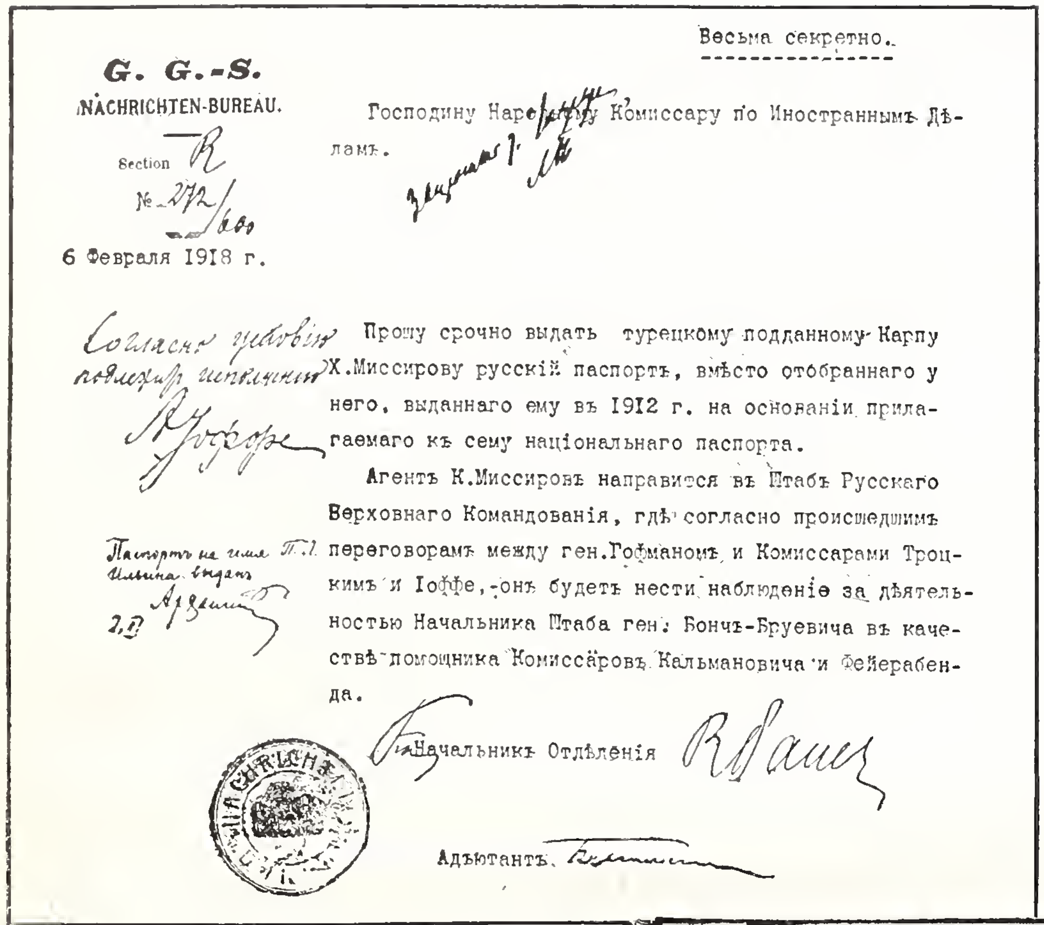
January 2, 1918.

TO THE COMMISSION ON COMBATING COUNTER REVOLUTION:

Commander in chief Krilenko has requested the Counter Espionage at the Army Headquarters to inform you that it is necessary to order the following persons to the Roumanian front immediately: From Petrograd, Commissar Kuhl, Socialist Rakovsky, Sailor Gnieshin; and from the front the chief of staff of the Red Guard, Durasov. These persons should be supplied with literature and with financial resources for agitation. To them is committed the task of taking all measures for the deposing of the Roumanian king and the removal of counter revolutionary Roumanian officers.

Director of Counter Espionage:
FEIERABEND.
Secretary: N. DRACHEV.

NOTE.—*This marks the continuance of large-scale work to disorganize the Roumanian army. That it advances disappointingly to Germany is evidenced by vengeful steps taken by Gen. Hoffman and Trotsky from Brest-Litovsk, when in the middle of January*



G. G.-S.
NACHRICHTEN-BUREAU.
Section R
№ 272/600
6 Февраля 1918 г.

Весьма секретно.

Господину Народному Комиссару по Иностраннымъ Дѣламъ.

Согласно условія подлежитъ исполненію
Иоффе

Прошу срочно выдать турецкому подданному Карпу Х.Миссирову русскій паспортъ, вмѣсто отобраннаго у него, выданнаго ему въ 1912 г. на основаніи прилагаемаго къ сему національнаго паспорта.

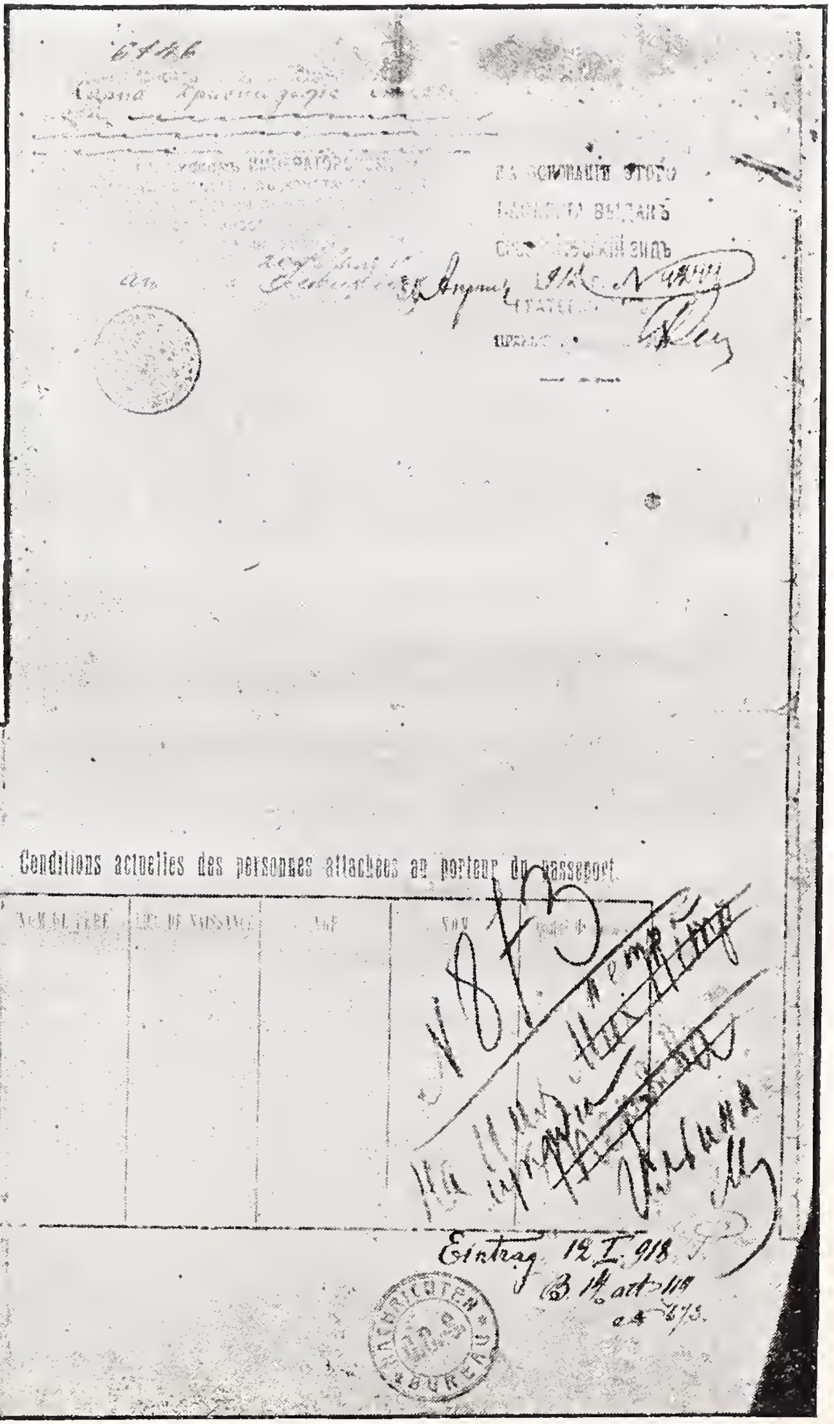
Агентъ К.Миссировъ направится въ Штабъ Русскаго Верховнаго Командованія, гдѣ согласно происшедшимъ переговорамъ между ген.Гофманомъ и Комиссарами Троцкимъ и Іоффе,-онъ будетъ нести наблюденіе за дѣятельностью Начальника Штаба ген. Бончъ-Бруевича въ качествѣ помощника Комиссаровъ Кальмановича и Фейерабенда.

Паспортъ на имя П. И. Ильина выданъ
2.II

Начальникъ Отдѣленія R. Bauer

Адъютантъ

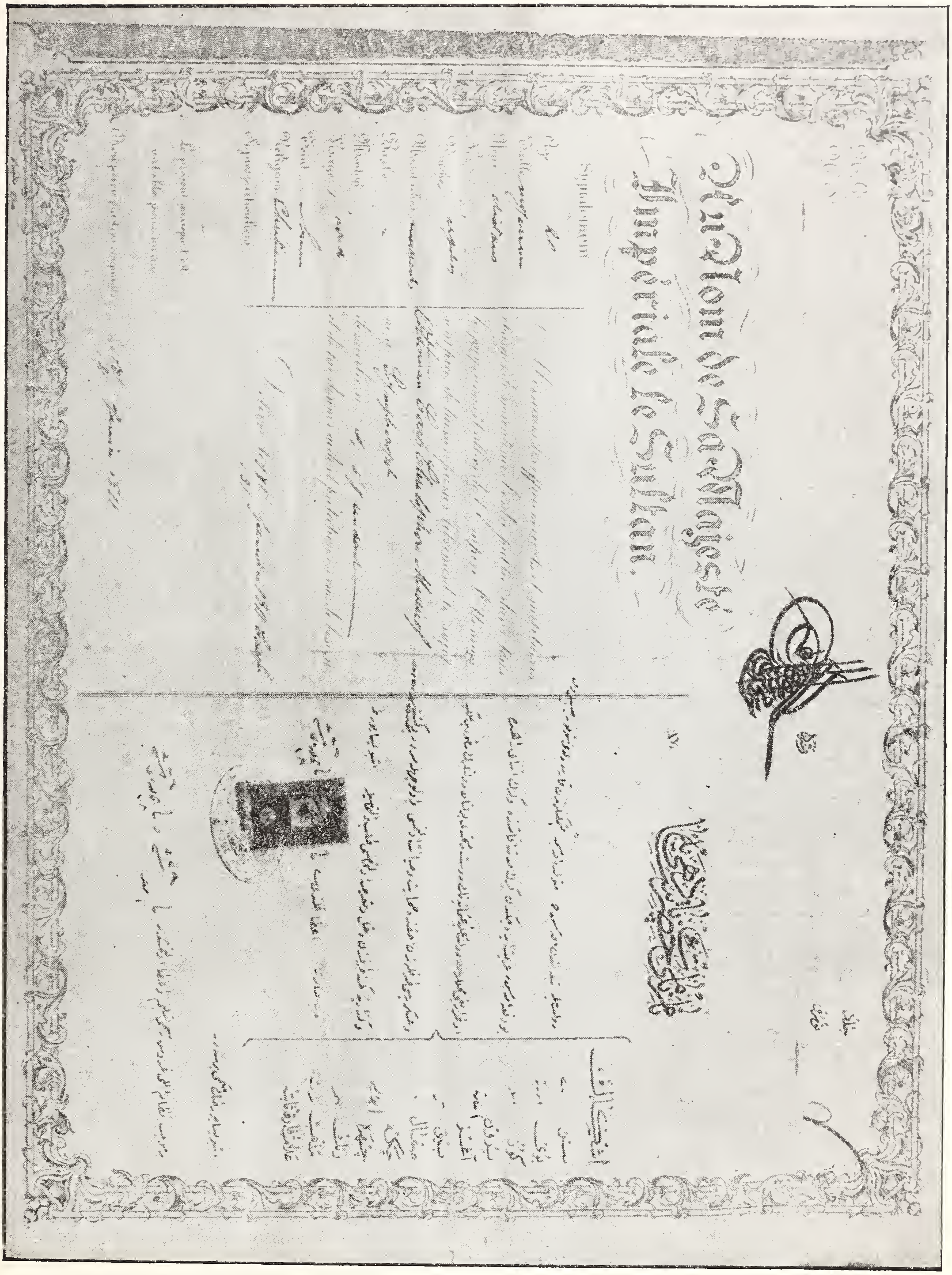
Above is shown facsimile of Document Number 32, asking Trotsky to appoint the Turk, C. Missiroff, as a spy on Gen. Bonch-Bruevich and bearing Joffe's notation, "According to agreement, it must be done."



Conditions actuelles des personnes attachées au porteur du passeport.

Eintrag 12. I. 918

Facsimile of reverse of Turkish passport. Notice the stamp of year 1912, in which year a Russian passport first was given bearer. Notice also the recent stamp of Nachrichten Bureau.



Au Nom de Sa Majesté
Impériale le Sultan.

Signalement

Facsimile of face of Turkish passport surrendered by Missiroff. Notice that the passport was given him by Turkey in 1911. Letter No. 32 indicates that he had a previous Russian passport delivered to him in 1912, on basis of Turkish passport.

(western calendar) Trotsky, at the request of Gen. Hoffman, ordered the arrest in Petrograd of the Roumanian minister Diamandi. (See Document 37A.)

At about the same time the Roumanian public gold reserves in custody within the Kremlin walls at Moscow were seized by the Russian Government. Diamandi was released from arrest at the demand of the united diplomatic delegations at Petrograd, but his humiliations continued, and on January 28 he was ordered from Petrograd, being given less than 10 hours to prepare for the departure of a party that contained many women and children. Ambassador Francis sought in vain of Zalkind, who was acting as Foreign Minister in the absence of Trotsky again at Brest, for an extension of the time of departures. The Roumanian party was thrown pell-mell on a train at midnight. It was delayed in Finland on one excuse and another, not immediately apparent, but in three weeks the minister, leaving behind a large part of his people, was allowed to proceed to Torneo. By good luck he reached there the day after the Red Guard lost Torneo to the White Guard. That day saved his life, for on the person of Svetlitzsky, a Russian commissar who joined him in mid-Finland and accompanied him to Torneo, was found an order to Timofeyeff, the commissar at Torneo, to shoot him. Svetlitzsky was shot instead. When I passed through Torneo the control officer talked frankly about the details, expressing the opinion that the shooting might have been a mistake, as it was not shown that Svetlitzsky was aware of the contents of the letter. Svetlitzsky, however, was an important person in Petrograd, close to Trotsky. Our American party brought Guranesco, the first secretary of the Roumanian delegation, out of Finland through the lines with us. He had been in Red Finland seven weeks. Behind us at Bjorneborg we left several families of Roumanians who had departed from Petrograd with the minister. We would have liked to have brought them through the lines of the two armies, but our venture was too desperate to permit unauthorized additions to the party.

The marginal notation on this letter is "Execute," initialed "Ch," the sign manual of Chicherin, the returned exile from England, at that time Assistant Commissar of Foreign Affairs, now Minister of Foreign Affairs.

Have photograph of letter.

DOCUMENT 37A*

* The contents of this letter, written by Joffe, were telegraphed to Washington in February, and photographic copy of letter forwarded by Ambassador Francis to State Department.

No. 771, Affair of Peace Delegation

(*Confidential*)

Brest-Litovsk, December 31, 1917.

To the Council of People's Commissars:

Comrade L. Trotsky has charged me to bring to the knowledge of the Council of People's Commissars the motives for his telegraphic proposal to arrest the Roumanian diplomatic representatives in Petersburg.

Gen. Hoffman, referring to the conference which had taken place in Brest-Litovsk between the members of the German and Austro-Hungarian delegations on December 29, presented to the Russian delegation in the name of the German and Austrian Chief Command (a deciphered radio-telegram was exhibited in this connection) a *confidential demand* concerning the immediate incitement of the Roumanian army to recognize the necessity of an armistice and adopting the terms of a democratic peace pointed out by the Russian delegates. The implacability of the staff and the whole commanding force of the Roumanian army, with regard to which the Chief Command of the German army has received the most exact agency information, spoils the excellent impression produced in Germany and on all the fronts by the Russian peace propositions, which has made it possible to again *stimulate the popular feeling against England, France, and America and can bring about an undesirable and dangerous aggravation of the peace question, up to the German army going over to the attack on our front and an open annexation of the territories occupied in Russia.*

The general expressed his opinion that against peace might be the Cossacks, some Ukranian regiments, and the Caucasian army, in which case they will also doubtless be joined by the Roumanian armies, which, according to the information in possession of the German staff, enters into the calculations of Kaledin and Alexieff. It is greatly in the interests of the German and Austrian delegations that complete harmony should prevail on the entire Russian front as regards the conclusion of an armistice and adopting the terms of a separate peace between Russian and Germany, seeing that in this event the German and Austrian Chief Command will propose to Roumania their terms of peace, and will be in a position to take up their operative actions on the western front on a very large scale; at the same time Gen. Hoffman, in the course of a conversation with Comr. Trotsky, twice hinted at the necessity of immediately beginning these war operations.

When Comr. Trotsky declared that at the disposal of the council's power there are no means of influencing the Roumanian staff, Gen. Hoffman pointed out the necessity of sending trustworthy agents to the Roumanian army, and the possibility of arresting the Roumanian mission in Petersburg, and repressive measures against the Roumanian king and the Roumanian commanding forces.

After this interview Comr. L. Trotsky by cable proposed to arrest the Roumanian mission in Petersburg with all its members. This report is being sent by special courier—Comrade I. G. Brossoff, *who has to personally transmit to Commissar Podvoisky some information of a secret character regarding the sending to the Roumanian army of those persons whose names Comr. Brossoff will give.* All these persons will be paid out of the cash of the "German Naphtha-Industrial Bank," which has bought near Boreslav the business of the joint-stock company of Fanto & Co. The chief direction of those agents has been intrusted, according to Gen. Hoffman's indication, to a certain Wolf Vonigel, who is keeping a watch over the military agents of the countries allied with us. As regards the English and American diplomatic representatives, *Gen. Hoffman has expressed the agreement of the German staff to the measures adopted by Comr. Trotsky and Comr. Lazimiroff with regard to watching over their activity.*

Member of the delegation:

A. Joffe.

[*Marginal Notations*]

Comr. Shitkevitch: Take copies and send to the Commiss. for Foreign Affairs, personally to Comr. Zalkind.

[*Passages printed above in italics marked:*] To Sanders.

Reported January 4, regarding the arrest of Diamandi and others.

M. Shitkevitch.

January 5, 1918.—To the Chancery: Send an urgent telegram to Trotsky about the arrest of the Roumanian minister.—Savelieff.

Note (as cabled Feb. 9).—*The date is January 12, western calendar, the eve of the Russian New Year. The Roumanian minister was arrested that night in Petrograd, and only released on the united demand of all embassies and legations in Petrograd. Since then he has been sent out of Russia. The letter shows that Trotsky took Gen. Hoffman's personal demand as an order for action. Most important of all, however, it strips the mask from the Lenin and Trotsky public protestations that they have sought to prevent the peace negotiations with Germany from turning to the military advantage of Germany against the United States, England, and France. The aim here disclosed is instead to aid Germany in stimulating feeling against England, France, and the United States, in enabling Germany to prepare for an offensive on the western front. A German bank is named as paymaster for Bolshevik agitators among the Roumanian soldiers. Is "Wolf Vonigel," the field director, the Wolf von Igel of American notoriety? The similarity in name is striking. Finally, Gen. Hoffman and the German staff is satisfied with Trotsky's watch over the American and English diplomats. Joffe, who signs the letter, is a member of the Russian Peace Commission. Since this letter was written Zalkind has gone to Switzerland on a special mission.*

Note.—(July 6, 1918). *He did not reach there, being unable to pass through England, and in April was in Christiana.*

DOCUMENT NO. 38

Commission for Combating the Counter Revolution and Pogroms, No. —.

Petrograd, Dec. 14, 1917.

Major von Boehlke:

Esteemed Comrade: I bring to your notice that our Finnish comrades, Hakhia, Pukko, and Enrot have advised the Commissar for Combating the Counter Revolution of the following facts:

1. Between the English officers and the Finnish bourgeois organizations there are connections which cause us serious apprehension.
2. In Finland have been installed two wireless stations which are used by unknown persons who communicate in cipher.
3. Between Gen. Kaledin and the American mission there is an undoubted communication, of which we have received exact information from your source, and, therefore, a most careful supervision of the American Embassy is necessary.

These reports must be established exactly. Our agents are helpless. Please excuse that I write on the official letter heads, but I hasten to do this, sitting here at the commission at an extraordinary meeting. Ready to service.

F. Zalkind.

Note.—*The written comment at the top of the letter is: "Commissar for Foreign Affairs. I request exact instructions. Schott." It is von Boehlke's question, signed with his cipher name. (See document 5.) The letter may imply that von*

Boehlke had, in the opinion of his good friend Zalkind, a means of internal observation at the American Embassy.

Have photograph of letter.

DOCUMENT NO. 39

Counter Espionage at the Army Headquarters,
No. 268.

(Very Secret)

January 25, 1918.

To the Commission on Combating the Counter Revolution:

The 23d of January at the Army Headquarters [Stavka] there took place a conference at which there participated Maj. von Boehlke, assigned from Petrograd. It was decided, upon the insistence of the German consultants, to send to the internal fronts the following persons, furnishing them all powers for dealing with individual counter revolutionaries:

To the Don: Zhikhorev, Rudnev, Krogultz, and Ernest Delgau.

To the Caucasus Front: Vassili Dumbadze, Prince Machabelli, Sevastianov, and Ter-Baburin.

To the 1st Polish Corps of Gen. Dovbor-Menitsky are assigned Dembitski, Stetkus, Zhimiitis, and Gisman.

Be so good as to take all measures for the quick assignment and the adequate furnishing of the assigned persons with money, reserve passports, and other documents.

Senior officer: Peter Mironov.

Note.—*This is an assassination order against individuals. It was not successful against the Polish general. Dembadze and Prince Machabelli were German spies implicated in the Sukhomlinoff affair and sentenced to prison, but afterwards liberated by the Bolsheviks. Lieut. Col. Dembitski was a Bolshevik Polish officer. Baburin was an assistant chief of staff under Krilenko. The letter is indorsed: "Comrade Lunacharsky. Go and report to Comrade Zinovieff," signature illegible.*

Have photograph of letter.

DOCUMENT NO. 40

Counter Espionage at the Army Headquarters,
No. 51/572.

January 19, 1918.

To the Commission for Combating the Counter Revolution:

There have been received two notes addressed to the Supreme Commander from the staffs of the Austrian and German High Commands. These notes inform the Army Headquarters [Stavka] that the organizer of the volunteer army in the Don region, Gen. Alexieff, is in written communication with the officer personnel of the Polish legions at the front, with the view of getting the help of Polish officers in the counter revolution. This information has been received by the Austrian agents from the Polish Bolshevik Comrade Zhuk, who played a large part at Rostov during the November and December battles. On the other side, the representative of the German Government, Count Lerchenfeldt, reports of the rapidly growing movement in Poland in favor of the bourgeois estate owners' imperialistic plan to defend with arms the greatest possible independence of Poland, with the broadening of its frontiers at the expense of Lithuania, White Russia, and Galicia.

This movement is actively supported by the popular democratic party in Warsaw, as well as Petrograd, by military organizations guided by the counter revolutionary estate owners and the bourgeois Polish clergy.

The situation which has arisen was discussed on the 16th of January at the Stavka in the presence of Maj. von Boehlke, sent by the Petrograd branch of the German Intelligence Bureau, and it was there decided:

1. To take the most decisive measures, up to shooting *en masse*, against the Polish troops which have submitted to the counter revolutionary and imperialistic propaganda.

2. To arrest Gen. Dovbor-Menitsky.

3. To arrange a surveillance of the commanding personnel.

4. Send agitators to the Polish legions to consult regarding this the Polish revolutionary organizations known to the committee.

5. On learning of the counter revolutionary activity of Polish officers to immediately arrest them and send them to the Stavka at the disposal of the Counter Espionage.

6. To arrest the emissaries of Gen. Alexieff, Staff Capt. Shuravsky, and Capt. Rushitsky.

7. To request the Commission for Combating the Counter Revolution, in agreement with the German Intelligence Bureau at Petrograd, to arrange a surveillance and observation of the following institutions and persons:

(*a*) The military committee.

(*b*) The Society of Friends of the Polish Soldier.

(*c*) Inter-Party Union.

(*d*) The Union of Polish Invalids.

(*e*) Members of the Polish Group of the former state Duma and council.

(*f*) The chairman, Lednitsky, and the members of the former Committee for the Liquidation of Affairs of the Kingdom of Poland.

(*g*) Boleslav Jalovtski.

(*h*) Vladislav Grabski.

(*i*) Stanislav Shuritski.

(*j*) Roman Catholic Polish clergy.

(*k*) The Polish Treasury through which, according to agency reports, the governments of countries allied with Russia intend, with the assistance of the New York National City Bank, to supply with monetary resources the counter revolutionary camp.

(*l*) It is necessary to verify the private reports of several Lithuanian revolutionaries that among the Church Benevolent Funds, which are at the disposal of the Polish clergy, are the capitals of private persons who hid their money from requisition for the benefit of the state.

In case of establishment of any connection with the counter revolution, the guilty Polish institutions are to be liquidated, their leaders and also persons connected with the counter revolutionary activity are to be arrested, and sent to the disposal of the Stavka.

Chief of the Counter Espionage:
Feierabend.
Commissar: Kalmanovich.

Note.—*Again Germany, through Count Lerchenfeldt, was intriguing on both sides. Chiefly, however, the significance of the letter is in the thoroughness of the outlined German plan to crush the threat of armed opposition from the Polish legions of the Russian army. The troops were fired upon, as indicated. The preceding document really follows this in natural sequence. The next two further elucidate the situation for the benefit of the Poles of the outside world.*

Have photograph of letter.

DOCUMENT NO. 41

Counter Espionage at the Army Headquarters,
No. 461.

January 28, 1918.

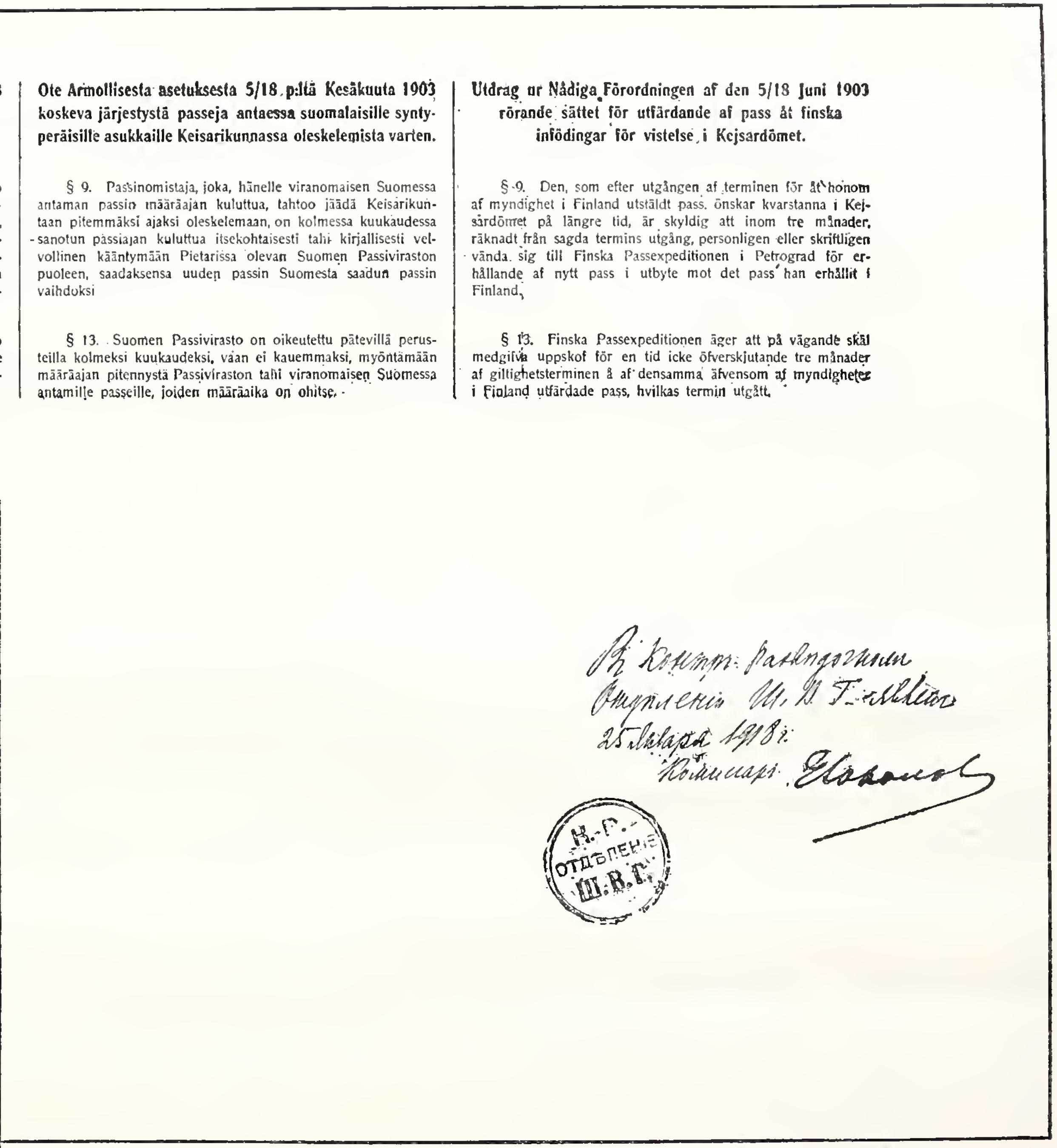
To the Commission for Combating the Counter Revolution:

The Special Constituent Commission on the conflict with the Polish counter revolutionary troops has begun its activity. All the conduct of its affairs has been located at the Counter Espionage at the Army Headquarters [Stavka], where is being collected all information on the counter revolution on the external and internal fronts. At the commission have arrived members of the Commission for Combating the Counter Revolution, E. Miekonoshin, I. Zenzinov, Zhilinski, and from Sevastopol Comrade Tiurin. To a conference were called agents announcing their wish to be sent for conflict with the bourgeois Polish officers: Lieut. Col. Dembitski, Boleslav Yakimovich, Roman Strievsky, Joseph Yasenovsky, and Mikhail Adamovich. All those agents are under obligation to carry the affair to the point of open insubordination of the soldiers against the officers and the arrest of the latter.

For emergency the commander in chief ordered to assign Nakhim Sher and Ilya Razymov for the destruction of the counter revolutionary ringleaders among the Polish troops, and the commission recognized the possibility of declaring all Polish troops outside the law, when that measure should present itself as imperative.

From Peterburg, observers announced that the Polish organizations are displaying great reserve and caution in mutual relations. There has been established, however, an unquestionable contact between the High Military Council located in Peterburg and the Polish officers and soldiers of the bourgeois estate-owning class with the counter revolutionary Polish troops. On this matter in the Commissariat on Military Affairs, there took place on January 22 a conference of Comrades Podvoisky, Kedrov, Boretzkov, Dybenko, and Kovalsky. The Commissar on Naval Affairs announced that the sailors Trushin, Markin, Peinkaitis, and Schultz demand the dismissal of the Polish troops, and threaten, in case it is refused, assaults on the Polish legionaries in Peterburg. The commander-in-chief suggests that it might be possible to direct the rage of the sailors mentioned, and of their group, to the front against the counter revolutionary Polish troops.

At the present time our agitation among the Polish troops is being car-



Извлеченіе изъ Высочайшаго Постановленія отъ 5/18 Іюня 1903 года о порядкѣ выдачи Финляндскимъ уроженцамъ видовъ на жительство въ Имперіи.

Ст. 9. Лица, которыя, по истеченіи срока выданнаго имъ Финляндскими властями вида на жительство, пожелаютъ остаться въ Имперіи на болѣе продолжительное время, обязаны въ теченіе трехъ мѣсяцевъ со дня истеченія упомянутаго срока, лично или письменно, обратиться въ Финляндскую Паспортную Экспедицію въ Петроградѣ за новымъ видомъ на жительство въ обмѣнъ на видъ, полученный ими въ Финляндіи.

Ст. 13. Финляндская Паспортная Экспедиція, по особо уважительнымъ причинамъ, отсрочиваетъ, на время не свыше трехъ мѣсяцевъ, дѣйствіе выданныхъ ею, а равно и Финляндскими властями, видовъ на жительство, срокъ коихъ истекъ

Ote Armollisesta asetuksesta 5/18 p:ltä Kesäkuuta 1903 koskeva järjestystä passeja antaessa suomalaisille syntyperäisille asukkaille Keisarikunnassa oleskelemista varten.

§ 9. Passinomistaja, joka, hänelle viranomaisen Suomessa antaman passin määräajan kuluttua, tahtoo jäädä Keisarikuntaan pitemmäksi ajaksi oleskelemaan, on kolmessa kuukaudessa sanotun passiajan kuluttua itsekohtaisesti tahi kirjallisesti velvollinen kääntymään Pietarissa olevan Suomen Passiviraston puoleen, saadaksensa uuden passin Suomesta saadun passin vaihdoksi

§ 13. Suomen Passivirasto on oikeutettu pätevillä perusteilla kolmeksi kuukaudeksi, vaan ei kauemmaksi, myöntämään määräajan pitennystä Passiviraston tahi viranomaisen Suomessa antamille passeille, joiden määräaika on ohitse.

Utdrag ur Nådiga Förordningen af den 5/18 Juni 1903 rörande sättet för utfärdande af pass åt finska infödingar för vistelse i Kejsardömet.

§ 9. Den, som efter utgången af terminen för åt honom af myndighet i Finland utstäldt pass, önskar kvarstanna i Kejsardömet på längre tid, är skyldig att inom tre månader, räknadt från sagda termins utgång, personligen eller skriftligen vända sig till Finska Passexpeditionen i Petrograd för erhållande af nytt pass i utbyte mot det pass han erhållit i Finland,

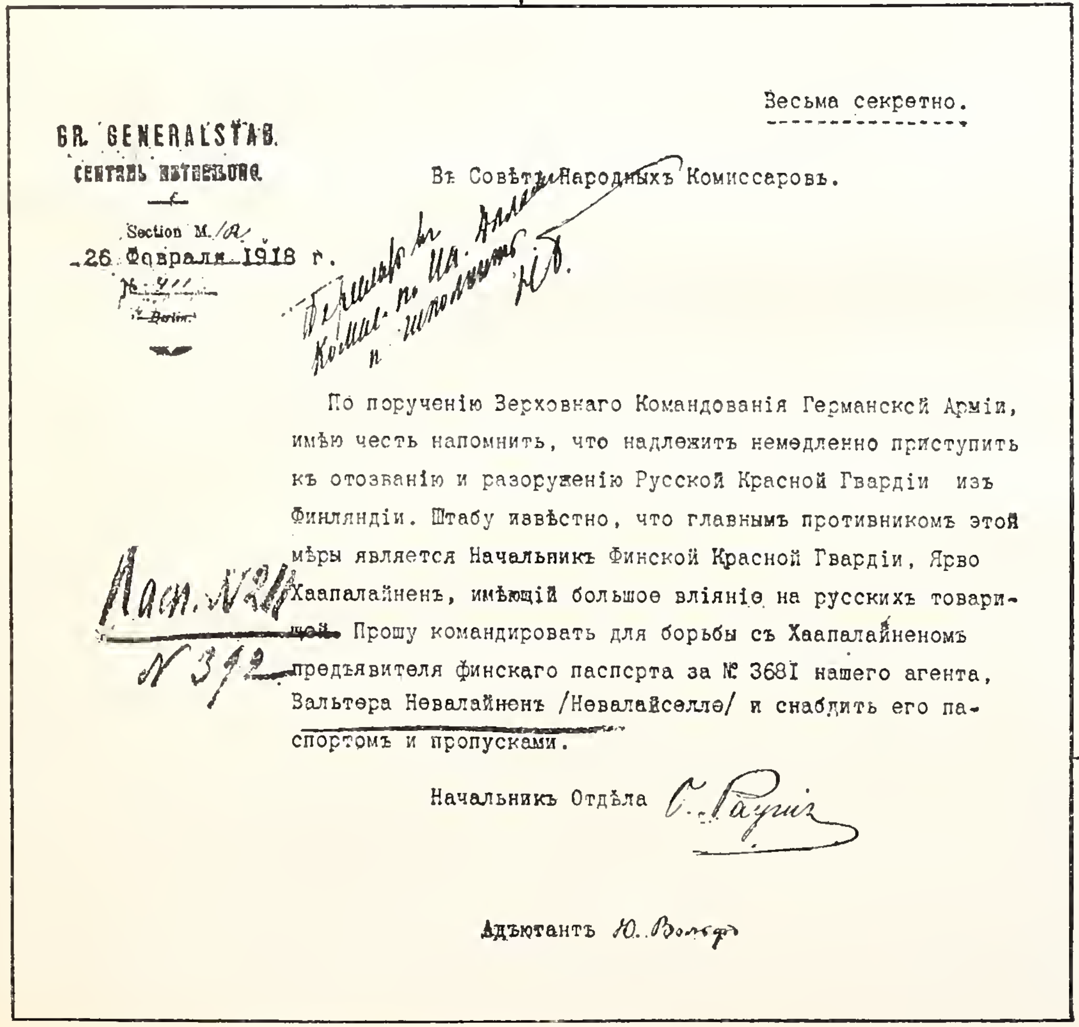
§ 13. Finska Passexpeditionen äger att på vägande skäl medgifva uppskof för en tid icke öfverskjutande tre månader af giltighetsterminen å af densamma äfvensom af myndigheter i Finland utfärdade pass, hvilkas termin utgått.

Въ контр-развѣдочное
Отдѣленіе Ш. Р. Г.
25 Лютага 1918 г.
Комиссаръ

Н.-Г. ОТДѢЛЕНІЕ Ш.Р.Г.

Above is shown facsimile of reverse of Nevalainen's Finnish passport, which he surrendered in receipt for Russian passport.

Below is shown facsimile of Letter Number 43, ordering issuance of new passport to the Finn, Nevalainen.



Весьма секретно.

GR. GENERALSTAB.
CENTRAL ABTEILUNG
Section M /a/
26 Февраля 1918 г.
№ 411
Berlin

Въ Совѣтъ Народныхъ Комиссаровъ.

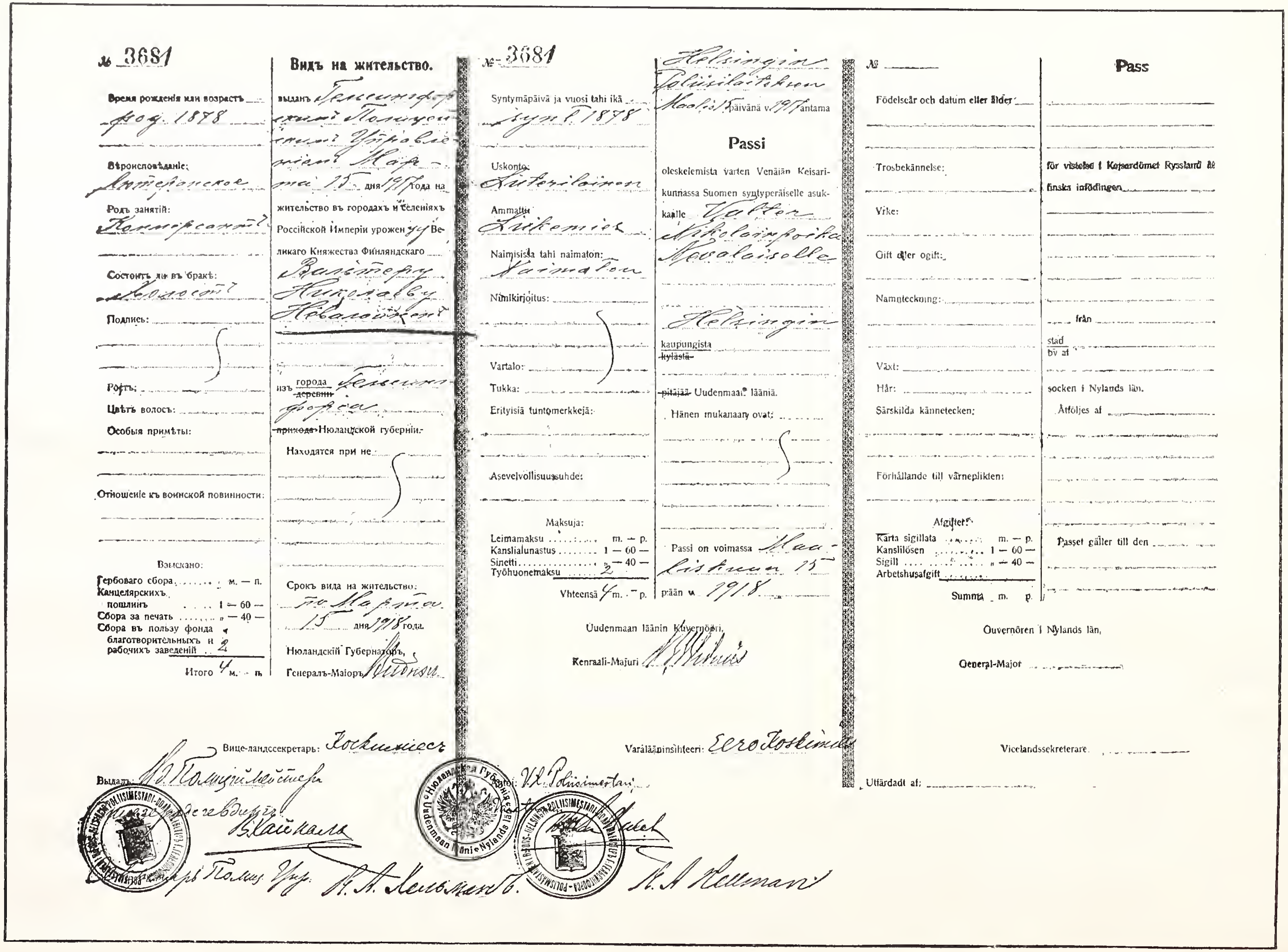
Передать въ Комис. по Ин. Дѣл. и исполнить Н. Г.

По порученію Зерховнаго Командованія Германской Арміи, имѣю честь напомнить, что надлежитъ немедленно приступить къ отозванію и разоруженію Русской Красной Гвардіи изъ Финляндіи. Штабу извѣстно, что главнымъ противникомъ этой мѣры является Начальникъ Финской Красной Гвардіи, Ярво Хаапалайненъ, имѣющій большое вліяніе на русскихъ товарищей. Прошу командировать для борьбы съ Хаапалайненомъ предъявителя финскаго паспорта за № 3681 нашего агента, Вальтера Невалайненъ /Невалайселле/ и снабдить его паспортомъ и пропусками.

Пасп. №24
№ 392

Начальникъ Отдѣла

Адъютантъ Ю. Вольфъ



№ 3681

Время рожденія или возрастъ [illegible] 1878

Вѣроисповѣданіе: Лютеранское

Родъ занятій: Коммерсантъ

Состоитъ ли въ бракѣ: Холостой

Подпись:

Ростъ:

Цвѣтъ волосъ:

Особыя примѣты:

Отношеніе къ воинской повинности:

Взыскано:

Гербоваго сбора	м. — п.
Канцелярскихъ пошлинъ	1 — 60 —
Сбора за печать	„ — 40 —
Сбора въ пользу фонда благотворительныхъ и рабочихъ заведеній	2
Итого	4 м. — п.

Видъ на жительство.

выданъ Гельсингфорсскимъ Полицейскимъ Управленіемъ Марта 15 дня 1917 года на жительство въ городахъ и селеніяхъ Россійской Имперіи урожен цу Великаго Княжества Финляндскаго Вальтеру Николаеву Невалайненъ

изъ города ~~деревни~~ Гельсингфорса ~~прихода~~ Нюландской губерніи.

Находятся при не

Срокъ вида на жительство: по Марта 15 дня 1918 года.

Нюландскій Губернаторъ,

Генералъ-Маіоръ

Вице-ландссекретарь: Коскиниеcъ

Выдалъ: И. д. Полицеймейстера

Секретарь Полиц. Упр. Н. А. Лельманъ

№ 3681

Syntymäpäivä ja vuosi tahi ikä [illegible] 1878

Uskonto: Luterilainen

Ammatti: Liikemies

Naimisissa tahi naimaton: Naimaton

Nimikirjoitus:

Vartalo:

Tukka:

Erityisiä tuntomerkkejä:

Asevelvollisuussuhde:

Maksuja:

Leimamaksu	m. — p.
Kanslialunastus	1 — 60 —
Sinetti	„ — 40 —
Työhuonemaksu	2
Yhteensä	4 m. — p.

Helsingin Poliisilaitoksen Maalisk. 15 päivänä v. 1917 antama

Passi

oleskelemista varten Venäjän Keisarikunnassa Suomen syntyperäiselle asukkaalle Valter Nikolainpoika Nevalaiselle

Helsingin kaupungista ~~kylästä~~ ~~pitäjää~~ Uudenmaan lääniä.

Hänen mukanaan ovat:

Passi on voimassa Maaliskuun 15 pään v. 1918

Uudenmaan läänin Kuvernööri,

Kenraali-Majuri

Varalääninsihteeri: Eero Koskinen

Antoi: V. t. Poliisimestari

N. A. Lellman

№

Pass

Födelseår och datum eller ålder

Trosbekännelse:

Yrke:

Gift eller ogift:

Namnteckning:

Växt:

Hår:

Särskilda kännetecken:

Förhållande till värneplikten:

Afgifter:

Karta sigillata	m. — p.
Kanslilösen	1 — 60 —
Sigill	„ — 40 —
Arbetshusafgift	
Summa	m. p.

för vistelse i Kejsardömet Ryssland åt finska infödingen

från stad by af socken i Nylands län.

Åtföljes af

Passet gäller till den

Guvernören i Nylands län,

General-Major

Vicelandssekreterare

Utfärdadt af:

Facsimile of front of Finnish passport surrendered by Nevalainen in order to receive the Russian passport referred to in Document Number 43.

ried on in very active fashion and there is great hope for the disorganization of the Polish legionaries.

Chief of Counter Espionage:
FEIERABEND.
Secretary: IV. ALEXIEFF.

NOTE.—*Have photograph of letter.*

DOCUMENT NO. 42

Counter Espionage at the Army Headquarters, No. 21.

January 28, 1918.

TO THE COMMISSION FOR COMBATING THE COUNTER REVOLUTION:

At the request of the commander in chief, in answer to your inquiry, I inform you, supplementary to the dispatch, that the funds sent with Maj. Bayermeister have been received here. Among the troops acting on the front against the counter revolutionaries have been prepared several battalions for conflict with the Poles and Roumanians. We will pay 12 roubles a day, with an increased food ration. From the hired sections sent against the legionaries have been formed two companies, one from the best shots for the shooting of officer-regiments, the other of Lithuanians and Letts for the spoiling of food reserves in Vitebsk, Minsk, and Mogilev governments, in the places where the Polish troops are situated. Various local peasants have also agreed to attack the regiments and exterminate them.

Commissar: G. MOSHOLOV.
Secretary: IV. ALEXIEFF.

NOTE.—*These two documents show that the policy against these patriotic soldiers was one of merciless extermination, financed by German money, handed out by a German officer. Bayermeister is named in Document No. 5.*

Have photograph of letter.

CHAPTER VI.

THE COMPLETE SURRENDER

The following documents show the complete surrender of the Bolshevik leaders to their German masters:

DOCUMENT NO. 43

G[reat] General Staff, Central Division, Section M-R, No. 411.

February 26, 1918.

(Very Secret)

TO THE COUNCIL OF PEOPLE'S COMMISSARS:

According to instructions from the High Command of the German Army, I have the honor to remind you that the withdrawing and disarming of the Russian Red Guard from Finland must be commenced immediately. It is known to the staff that the chief opponent of this step is the head of the Finnish Red Guard, Yarvo Haapalainen, who has a great influence on the Russian *tovarische* [comrades]. I request you to assign for this struggle with Haapalainen our agent, Walter Nevalainen (Nevalaiselle), bearer of Finnish passport 3681, and supply him with a passport and passes.

Head of the Division:
O. RAUSCH.
Adjutant: U. WOLFF.

NOTE.—*Written at the top of the letter and signed N. G., the initials of Lenin's secretary, N. Gorbunov, is the order: "Send to the Commissar of Foreign Affairs and execute." In the margin is written "Passport 211—No. 392," but unfortunately the name under which the new passport was given is not mentioned. This order explains the withdrawal of the Russian Red Guard from Finland in early March and the abandonment of the Finnish Red Guard to its fate. The latter, however, took care of the disarming both of Russian soldiers and sailors as they left Finland, for the Finns needed guns and ammunition. The Russians sometimes fought but were surrounded and disarmed. In Helsingfors while I was there in March the Red Guard and the sailors were fighting each other nightly with rifles and machine guns. One of two Finnish Red Guard leaders almost surely is Nevalainen, but under the circumstances I do not care to speculate.*

The order to hold all foreign embassies in Red Finland was given coincidently with the appearance of one of them upon the scene. The excuse offered was that foreigners were carrying information to the White Guard. Simultaneously influence was exerted in the White Guard to increase difficulties in passage between the lines. It is reasonable to place the obstacles to passage created on both sides of the Finnish line to German effort, for German aid was being given the White Guard openly at the moment it was intriguing in the inner councils of the Red Guard. The American party cornered in Finland escaped only by persistence and good fortune. The British Embassy party was passed through the day before the closing order came. The French and Italian Embassies were obliged after a month of vain effort to return to Russia.

Have original letter and the surrendered passport.

DOCUMENT NO. 44

G. G.-S., Intelligence Bureau, Section R, No. 283.

February 7, 1918.

TO THE COMMISSAR OF FOREIGN AFFAIRS:

We are told that secret service agents attached to the Army Headquarters [Stavka] are following Maj. Erich, who has been ordered to Kieff. I ask you to take urgent measures to remove the surveillance of the above-named officer.

Head of the Bureau: AGASFER.
Adjutant: BUKHOLM.

NOTE.—*Chicherin, assistant foreign minister, initials a marginal comment, "Talk it over." This note marks the period of acute irritation over the Ukraine between Bolsheviks and Germans. Agasfer is Maj. Luberts.*

Have original letter.

DOCUMENT NO. 45

G. G.-S., Intelligence Bureau, Section R, No. 228.

February 4, 1918.

TO THE COMMISSAR OF FOREIGN AFFAIRS:

By instructions of the representative of our staff I have the honor to ask you immediately to recall from the Ukrainian front the agitators Bryansky, Wolf, Drabkin, and Pittsker. Their activity has been recognized as dangerous by the German General Staff.

Head of the Bureau:
AGASFER.
Adjutant: HENRICH.

NOTE.—*An exchange of courtesies of the same period as Document No. 44. Chicherin has notated it, "Discuss."*

Have original letter, and also photo secured earlier.

DOCUMENT NO. 46

G. G.-S., Intelligence Bureau, Section R, No. 238.

February 3, 1918.

TO THE COMMISSAR OF FOREIGN AFFAIRS:

According to instructions of the representative of our General Staff, I have the honor once more to insist that you recall from Esthonia, Lithuania, and Courland all agitators of the Central Executive Committee of the Council of Workmen's and Soldiers' Deputies.

Head of the Bureau: AGASFER.
Adjutant: BUKHOLM.

NOTE.—*Another instance of the time when Germany was using an iron hand of discipline, clearing of agitators the Provinces it already had announced its intention of seizing for its own. The letter was referred by Markin, one of Trotsky's secretaries, to Volodarsky, who seems to have been in charge of the proletarian agitation in these Provinces.*

Have original of letter, and also photo secured earlier.

DOCUMENT NO. 47

G. G.-S., Intelligence Bureau, Section R, No. 317.

TO THE COUNCIL OF PEOPLE'S COMMISSARS:

The Intelligence Bureau has received precise information that the agitators of the Petrograd Council of Workmen's and Soldiers' Deputies, Volodarski, Brosoff, and Guschin, have completely changed the character of the Esthonia socialists' activity, which finally led to the local German landlords being declared outlawed. By order of the General Staff I ask you to take immediate steps for the restoring of the rights of the above-mentioned German landlords and the recalling of the agitators.

For the head of the Bureau:
R. BAUER.
Adjutant: E. RATITZ.

NOTE.—*This order for the release of the German landlords was at once obeyed, and the act of surrender, evidently at the direct order of Lenin, to whom this letter is addressed, marked the end of the incipient rebellion of the Bolshevik leaders against their German masters.*

Have photograph of letter.

VARIED ACTIVITIES

The following documents show various miscellaneous activities, including measures for the assassination of counter revolutionaries:

DOCUMENT NO. 48

Counter Espionage at the Army Headquarters, No. —

January 22, 1918.

To the Council of People's Commissars:

By our agents it has been established that connections between the Poles, the Don, and French officers, and also probably the diplomatic representatives of the allied powers, are maintained by means of Russian officers traveling under the guise of sack speculators. In view of this we request you to take measures for the strict surveillance of the latter.

Commissar: Kalmanovich.

Note.—*The indorsement on this is by Gorbunoff, "Copy to inform Podvoisky and Dzerzhinsky." The former was War Minister, the latter chairman of the Commission for Combating the Counter Revolution. Sack speculators were food peddlers who went into the provinces and brought food to the cities for profitable sale. Soldiers practically had a monopoly of the trade.*

Have photograph of letter.

DOCUMENT NO. 49

G[reat] General Staff, Intelligence Bureau, Section R, No. 151.

December 4, 1917.

To the Commissariat of Military Affairs:

Herewith the Intelligence Bureau has the honor to transmit a list of the persons of Russian origin who are in the service of the German Intelligence Department:

Sakharoff, officer First Infantry Reserve Regiment; Ensign Ter-Arytiuniantz, Zanko, Yarchuk, Golovin, Zhuk, Ilinsky, Cherniavsky, Capt. Postinkov, Schneier, Sailors Trushin and Gavrilov. All the persons mentioned are on the permanent staff of the Intelligence Bureau of the German General Staff.

Head of the Bureau:
Agasfer.
Adjutant: Henrich.

Note.—*Have photograph of letter.*

DOCUMENT NO. 50

G[reat] General Staff, Central Division, Section M, No. 22.

January 14, 1918.

(Very Confidential)

To the Chairman of the People's Council of Commissars:

The Russian Division of the German General Staff has received an urgent report from our agents at Novocherkash and Rostoff that the friction which has arisen between Gen. Alexieff and Gen. Kaledin, after which the volunteer corps of Gen. Alexieff began the movement to the north, is a tactical step to have a base in the rear. In this way the army of Gen. Alexieff will have a reliable rear base, protected by Cossack troops, for supplying the army, and a base in case of an overwhelming movement on the part of the enemy. The communications of Gen. Alexieff with the Polish troops have been proved by new reports of the Polish Bolshevik commissars, Zhuk and Dembitski.

Chief of the Division of General Staff: O. Rausch.
Chief Adjutant: R. Krieger.

Note.—*Important as showing that the German had a real fear of the military possibilities in the Alexieff-Kaledin movement. The suicide of Gen. Kaledin at a moment of depression, following betrayals that undoubtedly were carefully plotted, was tragically a part of the great national tragedy.*

Have photograph of letter.

DOCUMENT NO. 51

Counter Espionage at the Army Headquarters, No. 263/79.

January 23, 1918.

To the Commissariat of Foreign Affairs:

To your inquiry regarding those agents who might be able to give an exact report of the sentiment of the troops and population in the Provinces, I transmit to you a short list of the Russo-German agents-informers: In Voronezh, S. Sirtzoff; in Rostoff, Globoff and Melikoff; in Tiflis, Enskidze and Gavriloff; in Kazan, Pfaltz; in Samara, Oaipoff and Voenig; in Omsk, Blagovenschensky and Sipko; in Tomsk, Dattan, Tarasoff, and Rodionoff; in Irkutsk, Zhinzherova and Geze; in Vladivostok, Buttenhoff, Pannoff, and Erlanger.

Chief of Counter Espionage:
Feierabend.
Commissar: Kalmanovich.

Note.—*Apart from the list of agents this letter has interest from the comment: "To the company of Comrade Bonch-Bruevich and Secret Department." The signature is illegible.*

Have photograph of letter.

DOCUMENT NO. 52

Counter Espionage at the Army Headquarters, No. 395.

January 21, 1918.

To the Commission for Combating the Counter Revolution:

The agents of the Counter Espionage at the Stavka [Army Headquarters] have established that the anarchists Stepan Kriloff, Fedor Kutzi, and Albert Bremsen, at Helsingfors, and also Nahim Arshavsky, Ruphim Levin, and Mikhail Shatiloff had during the recent days a conference with the chief of staff of the Petrograd army district Shpilko. After Comrade Shpilko transmitted to the anarchists the offer of Comrade Antonoff and Comrade Bersin to recruit agents for the destruction of several counter revolutionists, the latter expressed their willingness and immediately began the recruiting. To Kieff are assigned the following, who have been hired at Helsingfors: S. Smirnoff and Rigamann; and to Odessa, Brack and Schulkovich.

For the Chief of the Counter Espionage.

Commissar: C. Moshlov.

Note.—*This is an assassination compact between Bolsheviks and anarchists. Antonoff, if one of the chief Bolshevik military leaders, is credited with the taking of Petrograd, and was in charge of the operations against Alexieff and Kaledin. The list of anarchists include several notorious characters.*

Have photograph of letter.

DOCUMENT NO. 53

Counter Espionage at the Army Headquarters, No. 471.

January 27, 1918.

To the Commission for Combating the Counter Revolution:

By us here there has been received a report from Finland, from Grishin and Rakhi, of the counter revolutionary activity of the lawyer, Jonas Kastren. This Kastren, in the years 1914-15 recruited on German funds Finnish volunteer regiments and sent them to Germany. For facilitating the work of recruiting he represented himself as a Socialist-Maximalist, and promised support to the Workers' Red Guard. In his office in Stockholm many of our comrades found a cordial reception and material support. Kastren furnished to Russia German money for the propaganda of Bolshevism in Russia. He had already established in 1916 a division of the German General Staff in Helsingfors. Now he, together with Svinhuvud, Ernroth, and Nandelschtedt, is on the side of the White Guards and is aiding them with money, supplies, and arms. We are informed that Kastren works both with German and English money. It is necessary immediately to cut short the work of Jonas Kastren and his group. The commander in chief advises to call to Petersburg the Finnish comrades, Rakhi and Pukho, or order Grishin to Helsingfors.

Commissar: A. Sivko.
Secretary: Iv. Alexieff.

Note.—*Kastren was still alive when I spent a week in Helsingfors in March, but he added to his chances of longevity by fleeing in early February to the White Guards headquarters at Vasa. The order for his removal came too late. Again we see Germany playing with both sides in Finland at the same time.*

Have photograph of letter.

APPENDIXES TO THE REPORT

APPENDIX I

DOCUMENTS CIRCULATED BY ANTI-BOLSHEVIKI IN RUSSIA

This appendix is of circulars of which (except in two cases noted) I have neither originals nor authenticated copies. A number of sets of them were put out in Russian text in Petrograd and in other parts of Russia in the winter (1917-18) by the opponents of the Bolsheviki. The circulars were declared to be copies of documents taken from the Counter Espionage Bureau of the Kerensky Government, supplemented by some earlier material from the same bureau when it was under the Imperial Government. The opportunity for securing them could easily have been afforded to the agents and employees of the Bureau, for most of the employees walked out when the Bolsheviki grasped the Government, and could have taken freely of the contents of their departments.

Some of the documents were included in the publication made in Paris, hitherto referred to.

I have not relied on them as proof, but they fit to other fabrics of proof, and in the light of it are more valuable for themselves than they were when they stood alone.

Two of the documents among these circulars are the circular of industrial mobilization of June 9, 1914, and the "destruction agents" circular of November 28, 1914. (See Document 3 of my Report.) This group of circulars came into my hands the first week in February, 1918, in an English version with the unknown translator's notes and a few days later two other sets, one in English and one in Russian, reached me. I prepared a digest of the set and Ambassador Francis cabled the message in code to the State Department February 9. It was nearly four weeks later before I secured the matter referred to in my Report as "Originals" and all the photographs listed in my Report. Two of these originals were of circulars I had seen in copy form four weeks earlier. That summarizes the case of the circulars of the appendix considered as evidence.

Edgar Sisson.

Analysis of German conspiracy matter, with notes as prepared by me and cabled State Department in Ambassador Francis's code February 9, 1918, and with some added notes, as indicated.*

DOCUMENT NO. 54

Circular February 18, 1914.—From the Ministry [of Finance] to all groups of German banks and, by agreement with the Austro-Hungarian Government, the Oesterreichische-Kreditanstalt:"

The managements of all German banks which are transacting business abroad and, by agreement with the Austro-Hungarian Government, the Oesterreichische-Kreditanstalt Bank, are hereby advised that the Imperial Government has deemed it to be of extreme necessity to ask the management of all institutions of credit to establish with all possible dispatch agencies in Luleo, Haparanda, and Varde, on the frontier of Finland, and in Bergen and Amsterdam. The establishment of such agencies for a more effective observation of the financial interests of German shareholders of Russian, French, and English concerns may become a necessity under certain circumstances, which would alter the situation of the industrial and financial market.

Moreover, the managements of banking institutions are urged emphatically to make provisions for very close and absolutely secret relations being established with Finnish and American banks. In this direction the ministry begs to recommend the [extremely active] Swedish Nia Banken in Stockholm, *the banking office of Furstenberg*, the commercial company, Waldemar Hansen, in Copenhagen, as concerns which are maintaining lively relations with Russia.—(Signature) No. 373. In charge of Division for Foreign Operations.

Note.—*This is the outline of the basic financial structure begun in February, 1914, five months before war was launched, and still in operation. Notice the reappearance in subsequent Lenin messages of towns Luleo and Varde. Likewise the reference to American banks. Olaf Ashberg, one of the heads of the Nia-Banken, came to Petrograd a month ago (January, 1918) and on the way boasted that Nia-Banken was the Bolshevik bank. He was overheard by one of our own group. He secured from Smolny permit for export several hundred thousand gallons of oil, opened at Hotel d'Europe headquarters where both Mirbach and Kaiserling of German commissions have been entertained, negotiated with State bank February 1 contract for buying cash roubles and establishing foreign credit for Russian Government. Furstenberg is now at Smolny using the name Ganetzky, is one of the inner group, and is likely soon to be placed in charge of State bank. Ashberg now in Stockholm, but returning.*

DOCUMENT NO. 55

Circular, November 2, 1914.—From the General Staff to all military attachés [agents] in the countries adjacent to Russia, France, Italy, and Norway.

In all branches of German banks in Sweden, Norway, Switzerland, [China,] and the United States special war credits have been opened for subsidiary war requirements. The General Staff is authorizing you to avail yourself in unlimited amounts of these credits for the destruction of the enemy's factories, plants, and the most important military and civil structures. Simultaneously with the instigation of strikes it is necessary to make provision for the damaging of motors, of mechanisms, with the destruction of vessels [carrying] military supplies to enemy countries] setting incendiary fires to stocks of raw materials and finished products, deprivation of large towns of their electric energy, stocks of fuel and provisions. Special agents, detailed to be at your disposal, will deliver to you explosive and incendiary devices, and a list of such persons in the country under your observation who will assume the duty of agents of destruction.—(Signed) Dr. [E.] Fischer, General Army Councilor.

Note (Oct. 10, 1918).—*Of the typewritten versions of this letter in my possession, one is dated June 9, 1914, and two are dated Nov. 2, 1914. The latter is the more likely date, and the chances are that June 9 is a typographical error. No evidence value has been placed on this circular, as the introduction to this chapter carefully points out.*

The case of the next circular, however, No. 56, of the date June 9, is different. Here the date is right, and has the corroborative support of Document No. 3.

DOCUMENT NO. 56

Circular, June 9, 1914.—General Staff to all [district] intendencies:

Within 24 hours after receipt of this circular you are to inform all industrial concerns by telegraph that the documents with industrial mobilization plans and with registration forms be opened, such as are referred to in the circular of the Commission of Count Waldersee and Count Caprivi, of June 27, 1887.—No. 421 re Mobilization.

[*Versions B and C read:* Within 24 hours of receipt of this circular notify by telegraph all owners of industrial enterprises to open packets with industrial mobilization statistics (*or* specifications) and plans, as stated in the circular, etc. *Both versions B and C add the note:* This circular was seized in the correspondence of Major Epeling with Consul Count Lerchenfeldt.]

Note.—*This is the content of circular of which I have original German printed circular in the form in which it is reproduced in my report in connection with Document No. 3. E. S., July 6, 1918.*

DOCUMENT NO. 57

Circular, November 2, 1914.—From the Imperial Bank to the representatives of the Nia-Banken and the agents of the Diskonto Gesellschaft and of the Deutsche-Bank:

At the present time there have been concluded conversations between the authorized agents of the Imperial Bank and the Russian revolutionaries, Messrs. Zinovieff [*here and below version A has* Zenzinoff] and Lunacharsky. Both the mentioned persons addressed themselves to several financial men, who for their part addressed themselves to our representatives. We are ready to support the agitation and propaganda projected by them in Russia on the [one] absolute condition that the agitation and propaganda noted [planned] by the above-mentioned Messrs. Zinovieff and Lunacharsky will touch the active armies at the front. In case the agents of the Imperial Bank should address themselves to your banks we beg you to open them the necessary credit which will be covered completely as soon as you make demand on Berlin.—(Signed) Risser.

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* The text which is presented in this publication is in the main that of the translation into English, by an unknown translator, which was cabled to the State Department. For convenience this is called version A. A second translation into English differing in extent and phraseology from the former is styled version B. The mimeographed set of these circulars in Russian, which Mr. Sisson secured, is referred to as version C; it agrees in the main with B so far as the latter extends. Version B does not include Documents 61 to 68 inclusive. Passages printed in italics in the text are in version A but not in B and C; passages in brackets are in B and C but are omitted in version A.

[*Addition as part of document*]: Zinovieff and Lunacharsky got in touch with Imperial Bank of Germany through the bankers, D. Rubenstein, Max Warburg, and Parvus. Zinovieff addressed himself to Rubenstein and Lunacharsky through Altvater to Warburg, through whom he found support in Parvus.

Note. — *Lunacharsky is the present People's Commissioner of Education. Parvus and Warburg both figure in the Lenin and Trotsky documents. Parvus is an agent at Copenhagen (see "New Europe," January 31, 1918, pp. 94-95). Warburg is believed to have been lately in Petrograd.*

DOCUMENT NO. 58

Circular, November 28, 1914.—From Naval General Staff to the naval attachés [*Version C reads* agents]:

You are ordered to mobilize immediately all destruction agents and observers [agents-observers and agents-destroyers] in those commercial and military ports where munitions are being loaded [may be loaded] on ships going to England, France, Canada, the United States of North America, and Russia, where there are storehouses of such munitions and where [naval] fighting units are stationed. It is necessary to hire through third parties who stand in no relationship to the official representatives of Germany, agents for arranging explosives [explosions] on ships bound for enemy countries, and for arranging delays, embroilments, and confusions during the loading, dispatching, and unloading of ships. For this purpose we are specially recommending for your attention loaders' gangs, amongst whom there are many anarchists and escaped criminals [and that you get in touch with*] German and neutral [shipping] offices, and [as a means of observing*] agents of enemy countries who are receiving and shipping the munitions. Funds required for the hiring and bribing of persons necessary for the designated purpose will be placed at your disposal at your request.—(Signed) No. 93. Secret Service Division of the Naval Staff. Koenig.

[*Original translator's comment (as part of document)*:] The above document was among the documents seized during the investigation of the fire of the storehouses of the firm of Iversen, and among the documents of Consul Gering and Vice Consul Gerold.

* In the German circular (see Document No. 3) but omitted in versions A, B, and C.

Note.—*This is an English translation, by an unknown translator, of circular of which I have German printed circular in form in which it is reproduced in connection with Document No. 3. See my Report, Document No. 3.—E. S., July 6, 1918.*

DOCUMENT NO. 59

Circular, January 15, 1915, from the General Staff to the military attachés [agents] in the United States:

Inclosed you will find [*original translator's note:* or, we are sending you] the circular of November 2, 1914, for your guidance and its application in the territory of the United States. In this connection your attention is called to the possibility of hiring destruction agents among members of anarchist [labor] organizations.—(Signed) General Army Councilor, Dr. [E.] Fischer.

[*Original translator's comment (as part of document)*:] This circular is recited in the letter of Dr. Klassen to the board of the Pan-German League in Stockholm, which was intercepted in Stockholm.

Notes (By Edgar Sisson, July 6, 1918).—*The date of November 2 appears in typed version as I have seen it, but probably this is error, as instruction is a direct sequel to document of November 28 (No. 3).* (Later.)—*Nov. 2 is right. Nov. 28 was to naval agents. This is to military agents.—E. S.*

DOCUMENT NO. 60

Circular, February 23, 1915.—Press Division of the Ministry of Foreign Affairs to all ambassadors, ministers, and consular officials in neutral countries:

You are hereby advised that in the country to which you are accredited special offices are established for the organization of propaganda in the countries of the coalition of powers which is in a state of belligerency with Germany. [*Versions B and C read:* in countries at war with German coalition]. The propaganda will be connected with the stirring up of social unrest and strikes resulting from it; of revolutionary outbreaks; of separatism among the component parts of the state; of civil war; and will also comprise agitation against [in favor of] disarmament and the discontinuation of the war butchery. You are requested to coöperate and to favor in every way the managers of said offices. These persons will present to you proper certificates [credentials].

(Signed) Barthelm.

[*Original translator's comment (as part of document)*:] According to reliable information to this category of persons belonged: Prince Hohenlohe, Björnson, Epeling [Eveling], Karsberg [Kerberg], Sukennikoff, Parvus, Furstenberg (Ganetsky), Ripke, and probably Kelyshko [Kolishko].

Note.—*Here is the exact German formula for the incitement of war "from the rear"—strikes, efforts at revolution, the use of humanitarian appeals to weaken the arm of its foes.*

DOCUMENT NO. 61

Circular, October 14, 1916.—From president of Kirdorff's Rhenish-Westphalian Industrial Syndicate to the central office of Nia-Banken in Stockholm, to Sevnsen-Baltzer, representative of the Diskonto-Gesellschaft in Stockholm, and to Mr. Kirch [Kriek], representative of Deutsche Bank in Switzerland:

The Rhenish-Westphalian Industrial Coal Syndicate charges you with the management of the account of which you have been apprised for the support of Russian emigrants desirous of conducting propaganda amongst Russian prisoners of war and the Russian army.—(Signed) Kirdorff.

Note.—*This document already figures in the archives of several Governments, having been intercepted in the correspondence of Prince von Buelow. It has new and direct pertinency on the Lenin-Trotsky data which follows herewith.*

DOCUMENT NO. 62

Copenhagen, June 18, 1917.

Mr. Ruffner [Ruffer], Helsingfors.

Dear Sir: Please be advised that from the Disconto-Gesellschaft account 315,000 marks have been transferred to Mr. Lenin's account in Kronstadt, as per order of the Syndicate. Kindly acknowledge receipt: Nilandeway 98, Copenhagen, W. Hansen & Co.—Svensen.

Note.—*Kronstadt, the navy base, was the nerve center from which Lenin's activities radiated during the summer, both before and after he fled Petrograd. He was not always there but it was the Bolshevik domain. The sailors were and still are his first dependence. Hansen & Co. are named in Document No. 54.*

DOCUMENT NO. 63

Geneva, June 16, 1917.

Mr. Furstenberg, Stockholm: Please note that at the request of Mr. Katz, francs 32,000 [82,000] have been paid for the publication of Maximalist-Socialist pamphlets. Advise by telegram addressed to Decker of the receipt of the consignment of pamphlets, number of bill of lading, and date of arrival. — (Signed) Kriek, Deutsche Bank.

Note.—*Furstenberg is named in Document No. 54 and is Ganetsky in Petrograd.*

DOCUMENT NO. 64

Stockholm, September 21, 1917.

Mr. Raphael Scholan [Schaumann], Haparanda.

Dear Comrade: The office of the banking house M. Warburg has opened in accordance with telegram from president of Rhenish-Westphalian Syndicate an account for the undertaking of Comrade Trotsky. The attorney [agent] purchased arms and has organized their transportation and delivery up to Luleo and Varde. Name to the office of Essen & Son in Luleo, receivers, and a person authorized to receive the money demanded by Comrade Trotsky.—J. Furstenberg.

Note.—*This is the first reference to Trotsky, and connects him with Banker Warburg and Furstenberg. Luleo and Varde are Swedish towns, the former near to Haparanda, which is on the border of Sweden and Finland.*

DOCUMENT NO. 65

Stockholm, September 12, 1917.

Mr. Farsen, Kronstadt (via Helsingfors): Carried out your commissions; passports and the indicated sum of 207,000 marks as per order of your Mr. Lenin have been handed to persons mentioned in your letter. The selection found the approval of his excellency, the ambassador. Confirm the arrival of said persons and the receipt of their counter receipts —Svenson.

Note.—*See Document No. 61. Lenin had received more than half a million marks at this date. (See also Document No. 68).*

DOCUMENT NO. 66

Luleo, October 2, 1917

Mr. Antonov, Haparanda: Comrade Trotsky's request has been carried out. From the account of the Syndicate and the ministry [*Original translator's note:* probably Ministry of Foreign Affairs in Berlin, press division] 400,000 kroners have been taken and remitted to Comrade Sonia, who will call on you with this letter, and will hand you the said sum of money.—J. Furstenberg.

Note.—*Antonov is the chief military leader of the Bolsheviki. He was in command of the forces that took Petrograd. He now is in the field against Kaledin and Alexieff. At the date of this letter Trotsky already was at the head of the Petrograd Soviet and the Bolsheviki revolution was only a month away.*

DOCUMENT NO. 67

Berlin [Copenhagen], August 25, 1917.

Mr. Olberg: Your desire considered together with the intentions of the Party. [*Version C reads:* Your wish, based on your correspondence with M. Gorky, falls in entirely with the aims of the Party.] By agreement with the persons known to you 150,000 kroners are transferred to be at your disposal at Furstenberg's office, through Nia-Banken. Kindly advise *Vorwärts* about everything that is being written by the newspaper [of M. Gorky] about present events.—Scheidemann.

Note.—*This letter from Scheidemann, the German Socialist leader, links him with Furstenberg-Ganetsky, with the Nia-Banken, and with the subsidy of the Russian revolution. "Vorwärts" refers to Scheidemann's organ at Berlin. Scheidemann's rôles both as German peace propagandist and as German strike queller are illumined by this letter.*

Note (Sept. 12, 1918).—*Gorky did support the Bolsheviks before they came into power, but almost immediately afterward turned against them.—E. S.*

DOCUMENT NO. 68

Berlin, July 14, 1917.

Mr. Mir [Mor], Stockholm: We are transferring to your name through Mr. I. Ruchvergen 180,000 marks [. Of this sum Engineer Steinberg will transmit 140,000 marks to Lenin] for the expense of your [his] journey to Finland. The balance will be at your disposal for agitation against England and France. The letters of Malianik and Stocklov, which were sent [by you] were received and will be considered.—Parvus.

Note.—*Lenin was in hiding in July. Report placed him, among other places, in Stockholm. Notice that the agitation is to be against England and France. It took the form from the opening days of the Bolshevik revolution of attacks upon them as "imperialistic nations." Parvus is the Copenhagen agent already referred to.—E. S., July 6, 1918.*

APPENDIX II

ILLUSTRATING THE "OFFENSE TACTICS" OF THE BOLSHEVIK LEADERS AGAINST GREAT BRITAIN AND THE UNITED STATES. —A CONVERSATION BY TELEGRAPH BETWEEN CHICHERIN AT PETROGRAD (WHO IS SPEAKING) AND TROTSKY AT BREST-LITOVSK, IN FIRST WEEK IN FEBRUARY, 1918, A FEW DAYS BEFORE TROTSKY MADE HIS "NO PEACE—NO WAR" GESTURE, WITH ITS PRACTICAL ASPECT OF DEMOBILIZING THE ARMY AND OPENING RUSSIA'S UNARMED BREAST TO GERMANY.

With reference to the allies the situation is evidently favorable. Separate peace will not cause a rupture. England has reconciled herself to this in advance. The recognition of us is a matter of the near future. England and America are playing up to us separately. A few days ago there appeared a so-called head of a commercial mission, Lockhart, with a letter from Litvinoff stating that the bearer is an honest man who indeed fully sympathizes with us. Indeed, he is a subtle, alert Englishman; expresses very liberal views; runs down his Government. He is a type of the diplomat of the new school. At present he is not an official representative, but *de facto* he is an envoy, having been sent by the war cabinet. After our recognition he will obtain an official position with us. He promises all kinds of favors from England. He explained that if we should not spoil the situation our recognition is a question of the near future, but something would have to be ceded on our part. He said that no government could tolerate intervention in its internal affairs. If we are going to raise the British people, if our agents in England will attempt to cause strikes, England will not tolerate this. It proved later that this had reference to Petroff's mission. Concerning the latter specially Lockhart said that his appointment would be difficult for England to swallow, and should he be arrested in England or not be allowed to land we would probably reply by reprisals, and thus the whole business would be spoiled. He begged that we postpone this matter for 10 or 12 days.

Simultaneously Ransome tried to persuade Petroff not to go to England. His journey in case of a conflict would put the question of a revolution in England on edge, which would be exceedingly risky. We discussed this question and decided that our strength was in attack, and that whatever would happen it would be the worse for Lloyd George & Co., and the revolution would be the gainer. We sent Petroff's passport to be viséed. Lockhart came running to us. I arranged for an interview with Petroff. Lockhart stated that the question had been referred for decision to London. We said that Russia represented a part of the world's revolutionary movement and that in this was its strength. We and our comrades in England would proclaim that this is not a concrete organization of strikes. We explained the aim of Petroff's mission—*i.e.*, the clearing up of misunderstandings between two nations. He will appeal to all organs of the British nation. This has also been sent by radio.

Lockhart stated that he was very well impressed and promised to telegraph advising that the visé should be granted. We await further developments. He stated that according to English information the German troops on the eastern front were so badly infected by our propaganda that no second course of barrack regime could cure them. He said that our method of fighting militarism was the most effective. We listened to this and laughed up our sleeves.

Note.—*There in the last sentence we have it. The Bolshevik plot in Russia could be placarded a cynical farce, if it were not a world tragedy. This appendix is from an intercepted dispatch which came into the possession of Mr. Sisson.*

PART II

I. LETTER OF MR. CREEL TO NATIONAL BOARD FOR HISTORICAL SERVICE

COMMITTEE ON PUBLIC INFORMATION,
WASHINGTON, D. C.

October 18, 1918.

PROFESSOR JOSEPH SCHAEFER, Vice--Chairman National Board for Historical Service, 1133 Woodward Building, Washington, D. C.

DEAR SIR:—Professor Ford tells me that the Directors of the National Board for Historical Service are meeting this afternoon at four o'clock, and I have asked him to take up with you the matter of considering the documents recently released for publication by the Committee on Public Information for the purpose of showing the intimate and continued connection of Lenin and Trotsky and their immediate associates with the German Government.

When only the opening installments of the series of seven had been published, the question of authenticity was raised by the New York *Evening Post*. The rest of the press of America, virtually without exception, accepted the fact of publication as evidence of the genuineness of the documents; and even the continued attempts of the New York *Evening Post* to rally the forces of doubt failed absolutely, only two men with any pretension of historical knowledge joining in any degree with the *Post*.

As a matter of course, the Committee on Public Information was committed from the first to a policy of absolute openness with regard to these documents. While never submitted to any unofficial body for purposes of investigation, it is nevertheless the fact that they have been gone over time and again by various agencies of the Government, and were not released for publication by this Committee until express sanction had been received from the highest authorities of the Government.

It was our idea from the first, and it is our idea now, to make pamphlet presentation of the documents, together with facsimile reproductions of all the more important originals. This task, attended by many mechanical difficulties, has just been completed.

The situation that now faces us is this: The documents were given to the press with the good faith of the Government behind them, and our promise is out to present them in pamphlet form with the photographic reproductions of originals. We cannot, in any manner, afford to appear dilatory or evasive, nor do we desire to publish the pamphlet without taking cognizance of the charges that have been made.

What I would like to do is to present the documents to a Committee, to be appointed by you, together with the charges that have been made, and to have these charges considered carefully with a view to determining their truth or falsity. If you will undertake this task, I would not desire to place any time limit upon you in any degree, but it is still the case that time is the very essence of the matter, for publication has been promised, and is waited for daily. May I suggest, therefore, that you appoint an authoritative committee, small in numbers, and that this committee assemble at once here in Washington where the necessary material is available for their information?

Believe me,

Very truly,

GEORGE CREEL,
Chairman.

The committee as appointed by the Executive Committee of the National Board for Historical Service, in response to the above request, consisted of Dr. J. Franklin Jameson, editor of the "American Historical Review" and Director of the Department of Historical Research of the Carnegie Institution of Washington; and Dr. Samuel N. Harper, Professor of Russian Language and Institutions in the University of Chicago.

II. REPORT OF THE SPECIAL COMMITTEE ON THE GENUINENESS OF THE DOCUMENTS

NATIONAL BOARD FOR HISTORICAL SERVICE.
WASHINGTON, D. C.:

October 26, 1918.

GEORGE CREEL, ESQ., Chairman of the Committee on Public Information, Washington, D. C.:

DEAR SIR:—By your letter of October 18, addressed to the vice-chairman of the National Board for Historical Service, you have asked that body to appoint a committee to examine, in respect to their genuineness, the series of documents purporting to show the relations between the Russian Bolshevist leaders and the German Government, which were released for publication in the September newspapers by the Committee on Public Information. You have asked that such committee should take into careful consideration the arguments against the genuineness of those documents put forward in the columns of the New York *Evening Post*, with a view to determine the validity or invalidity of those arguments. The undersigned were on October 19 appointed by the Board named to serve as a committee, and were requested by you to report our findings with the utmost frankness, regardless of any positions already publicly taken by you or by the Government. In pursuance of these instructions we beg leave to submit the following report.

As a basis for our work you have laid before us proof-sheets of a pamphlet edition of these documents, entitled *The German-Bolshevik Conspiracy*, and containing facsimiles of some sixteen of the documents in question, translations of documents numbered from 1 to 68, and of a few other documents subjoined to them, and comments and notes by Mr. Edgar Sisson, who procured the documents and edited them for the first or newspaper publication. The translations thus laid before us are those which appeared in the newspapers, and the documents bear the same numbers, by which, accordingly, we shall refer to them in this report. Mr. Sisson's comments include some additional notes, of October date, correcting and enlarging his previous comments in the light of information subsequently received.

Concerning the translations, though in strictness our function is limited to examination of originals, we will take the liberty to say that the versions put forth for publication in the newspapers are marked by grave imperfections. These imperfections we understand to have arisen naturally from the fact that Mr. Sisson, under the circumstances in which he worked in Petrograd and at other successive places, was obliged to have his translations made by several different hands. Whether the resulting unevenness and other imperfections should be removed before publication of the translations in a more permanent form, is a matter which we, of course, leave to your discretion; but we are obliged to allude to them because they have laid the documents open at certain points, some of which will be mentioned later, to suspicions which the originals of those passages nowise warrant.

Upon Mr. Sisson's inferences from his documents we do not understand that we are expected to comment, nor do we desire to express, or to be influenced by, any opinion respecting the conduct of Bolshevist leaders or German officials; our present duty, as we conceive it, is confined merely to examination into the genuineness of a specific series of documents.

You have also laid before us the original documents in sixteen cases, and in the other cases the photographs, on which all the translations from No. 1 to No. 53 were based, and also the mimeographed texts in Russian from which were made the translations from No. 54 to No. 68. Mr. Sisson has detailed to us, with all apparent candor, the history of his reception of the documents, and has permitted us to question him at great length as to these transactions and as to various points relative to the papers. Several officials of the Government in Washington have obliged us by contributing other pertinent and valuable information.

In presenting the results of our investigations, we find it desirable to distinguish the documents into three groups: first, and much the largest, (I) those presented to us in Russian originals or photographs—four-fifths of the whole set; (II) the two documents presented to us in circulars printed in German; (III) those documents for which no originals or photographs are presented, but the translations of which rest solely on mimeographed texts in Russian, purporting to represent originals in or from Russian archives.

In other words, our first group (I) consists of the documents bearing the numbers 1 to 53, inclusive. Our second group (II) consists of the two documents which appear translated in the newspaper publication as annexes to document No. 3. They also appear, with facsimiles, after No. 3 in the proposed pamphlet; and they are identical with Nos. 56 and 58 in the appendix. Our third group (III) embraces all the documents of Appendix I (Nos. 54 to 68, inclusive) except Nos. 56 and 58. We comment upon these groups separately.

I. The originals and photographs composing what we have called the first group are all in the Russian language. They are typewritten (save one which is printed) on letter-heads of the Petrograd bureau of the German General Staff, of the Counter-Espionage at the Stavka (army headquarters), or of other offices in Russia, German or Russian. They are dated according to the Russian calendar ("Old Style"), up to February, 1918, when the Bolshevist Government made the change to "New Style." We have subjected them with great care to all the applicable tests to which historical students are accustomed to subject documents of the kind, and to as many others as we could devise and use, consistently with the need of making a reasonably early report. Besides studying whatever internal evidences could be derived from the papers themselves, we have, so far as we could, compared their versions of what went on with the actual facts. Upon the basis of these investigations, we have no hesitation in declaring that we see no reason to doubt the genuineness or authenticity of these fifty-three documents.

II. The two documents of our second group seem to us to call for a special, a less confident, and a less simple verdict. Printed in German, they purport to be official German orders of the year 1914,—the one addressed on June 9 of that year, seven weeks before the outbreak of the war, by the

General Staff of the German Army to district commandants, enjoining them to cause German industrial establishments to open their instructions respecting industrial mobilization; the other, dated November 28, 1914, addressed by the General Staff of the High Sea Fleet to maritime agencies and naval societies, and calling on them to mobilize destructive agents in foreign harbors, with a view to thwarting shipments of munitions to "England, France, Canada, the United States, and Russia." The problem of their genuineness must be considered in connection with Documents Nos. 56 and 58 in the Appendix, which are nearly identical with them, differing in sense only as Russian translations might easily differ from German originals.

The errors of typography, of spelling, and even of grammar, in these German circulars, make it impossible to accept them as original prints of the General Staffs named. Certain peculiarities of expression tend in the same direction. In the naval circular the explanation, in parenthesis, of the German word *Vereinigungen* by the Russicism *Artelen* (Russian word with German plural ending) makes it impossible to think of the document as one printed by the German Naval Staff for use indifferently in *all* the various countries in which there were German maritime agencies and naval societies. Furthermore, the reference to the United States is puzzling. On the other hand, Document No. 3, a protocol which presents exceptional evidences of genuineness, records the transfer from Russian archives, into the hands of German military officials in Petrograd, of two documents which it not only designates by date and number but describes; and date, number, and description correspond to those of the two papers in question. There is other evidence in Washington of the existence of two such circulars, said to be of the dates named, in Petrograd archives in 1915. Attention should also be called to the manuscript annotations on the circulars, plainly visible in the facsimiles. On both appears, in blue pencil, a note which, properly translated, reads: "One copy given to the Nachrichten-Bureau.—Archive." That is to say, one printed copy has been handed over, in accordance with the formal record made in Document No. 3, to the Military Intelligence Bureau of the German General Staff (a bureau which then or soon after was housed under the same roof with the Bolshevist Government, in the Smolny Institute), while this present printed copy is to be put in the Russian archives. The circular dated June 9 bears also the annotation in red ink, "To the protocol [of] Nov. 2, 1917," confirming the connection asserted.

We do not think these two printed circulars to be simply forgeries. We do not think them to be, in their present shape, documents on whose entire text historians or publicists can safely rely as genuine. If we were to hazard a conjecture, it would be that they are derived, perhaps at one or two removes, from actual documents, which may have been copied in manuscript and at a later time reproduced in print. In any case, they have no relation to the Bolshevist officials, except indirectly through their connection with Document No. 3, which, with or without them, shows the Petrograd office of the German General Staff desirous of withdrawing certain papers from the Russian archives, and the Bolshevist Government complying with its desires.

III. For the documents of our third group, apart from Nos. 56 and 58, we have only the Russian mimeographed texts. The originals of nearly all of them would have been written in German. We have seen neither originals nor photographs, nor has Mr. Sisson, who rightly relegates these documents to an appendix, and expresses less confidence in their evidential value than in that of his main series, Nos. 1 to 53. With such insufficient means of testing their genuineness as can be afforded by Russian translations, we can make no confident declaration. Thrown back on internal evidence alone, we can only say that we see in these texts nothing that positively excludes the notion of their being genuine, little in any of them that makes it doubtful, though guarantees of their having been accurately copied, and accurately translated into Russian, are obviously lacking.

We should say the same (except that its original is not German) of the telegraphic conversation between Chicherin and Trotsky, which Mr. Sisson prints as Appendix II. The letter of Joffe, on the other hand, dated December 31, 1917, which he prints just after his No. 37,* stands on as strong a basis as documents Nos. 1 to 53, for Mr. Sisson had at one time a photograph of it, derived in the same manner as his other photographs.

As to the Reichsbank order of March 2, 1917, printed by him as an annex to Document No. 1, the text there presented does not purport to represent more than its general substance. The reader is not asked to rely on its accuracy and completeness, and we should not wish to do so.

It remains to consider the specific criticisms, as to genuineness of the documents, advanced by the New York *Evening Post* and its correspondents. Most of them fall away when it is known that the main series of documents, Nos. 1 to 53, are written in Russian and dated in accordance with the calendar currently used in Petrograd, and when it is considered that, as is well known, the Bolshevist *coup d'état* was expected in that city for some time before it took place.

Thus, the *Evening Post* (of September 16, 17, 18, 21, 1918) repeatedly scouts document No. 5, dated in the newspaper publication "October, 1917," and document No. 21, dated November 1, 1917,—letters addressed by the Petrograd bureau of the German General Staff to the Bolshevist Government—on the ground that on those dates, in the Berlin calendar, there was no Bolshevist Government, the Bolshevist *coup* having been delivered on November 7 of that calendar. But these documents are not of Berlin, though they are typewritten on letter-heads bearing that name in print, in the one case crossed out with the pen, in the other case not. Document No. 5 seems to have been written in Finland. We have been able to make out, in the photograph, the day-date in its heading. It is 25 October, *i.e.*, November 7 of New Style; and the Bolshevist acknowledgment at the bottom bears the date, not given in the newspaper publication, "27.X.1917," *i.e.*, November 9 of New Style. In other words, more cannot be said than that the German General Staff, not unaware of preparations of which all the world was aware in Petrograd, was prompt in action. It is a slight but significant touch that Colonel Rausch, writing from Finland on the day when the expected outbreak occurred, styles the new organization "Government (*Pravitelstvo*) of People's Commissaries" instead of "Council (*Soviet*) of People's Commissaries," the designation actually adopted.

The *Post's* criticism (September 16) of Document No. 2 on the ground of its mention of the "Petersburg Secret Police" (*Okhrana*), assumed by the writer to have been destroyed on March 10 or 11, seems to us to have no conclusive weight. The old Okhrana was abolished by the revolution, but the revolutionary Government itself had of course its secret service, to which a German might continue to apply the old name.

A correspondent of the *Post*, Mr. E. J. Omeltchenko, in its issue of October 4, rightly finds it singular that Dr. von Schanz, in Documents Nos. 8 and 9, should be represented as signing himself on January 8, "Representative of the Imperial Bank," and on January 12, "President of the Imperial Bank." It should be explained that the Russian word used is the same in both cases, *Predstavitel*, but that the translator of No. 9 wrongly translated it "President," while the translator of No. 8 translated it rightly, "Representative."

Mr. Omeltchenko also, with reference to Document No. 8, prints figures of the gold reserves of the Reichsbank and of the Bank of Sweden, November, 1917, to January, 1918, in the belief that, if the Reichsbank had at the beginning of January given the Bolshevist officials a credit in Sweden of 50,000,000 roubles gold, these figures would show the fact. We are informed on high financial authority that the Reichsbank would be able to effect such a transaction by means much less easily traced. Mr. Omeltchenko questions the need of the transaction, but the insecurity and unsettled conditions prevailing within the boundaries of the old Russian empire might easily account for the desire of the Bolsheviki to establish a large gold credit abroad without the necessity of actually exporting gold.

Professor Edward S. Corwin, in the same issue of the *Evening Post*, rightly criticises the date June 9, 1914, for Document No. 55. Its proper date appears to be November 2, 1914. The mimeographed Russian text bears that date. A translator, probably by confusion with No. 56, gave it the June date.

Respectfully submitted,

J. Franklin Jameson.
Samuel N. Harper.

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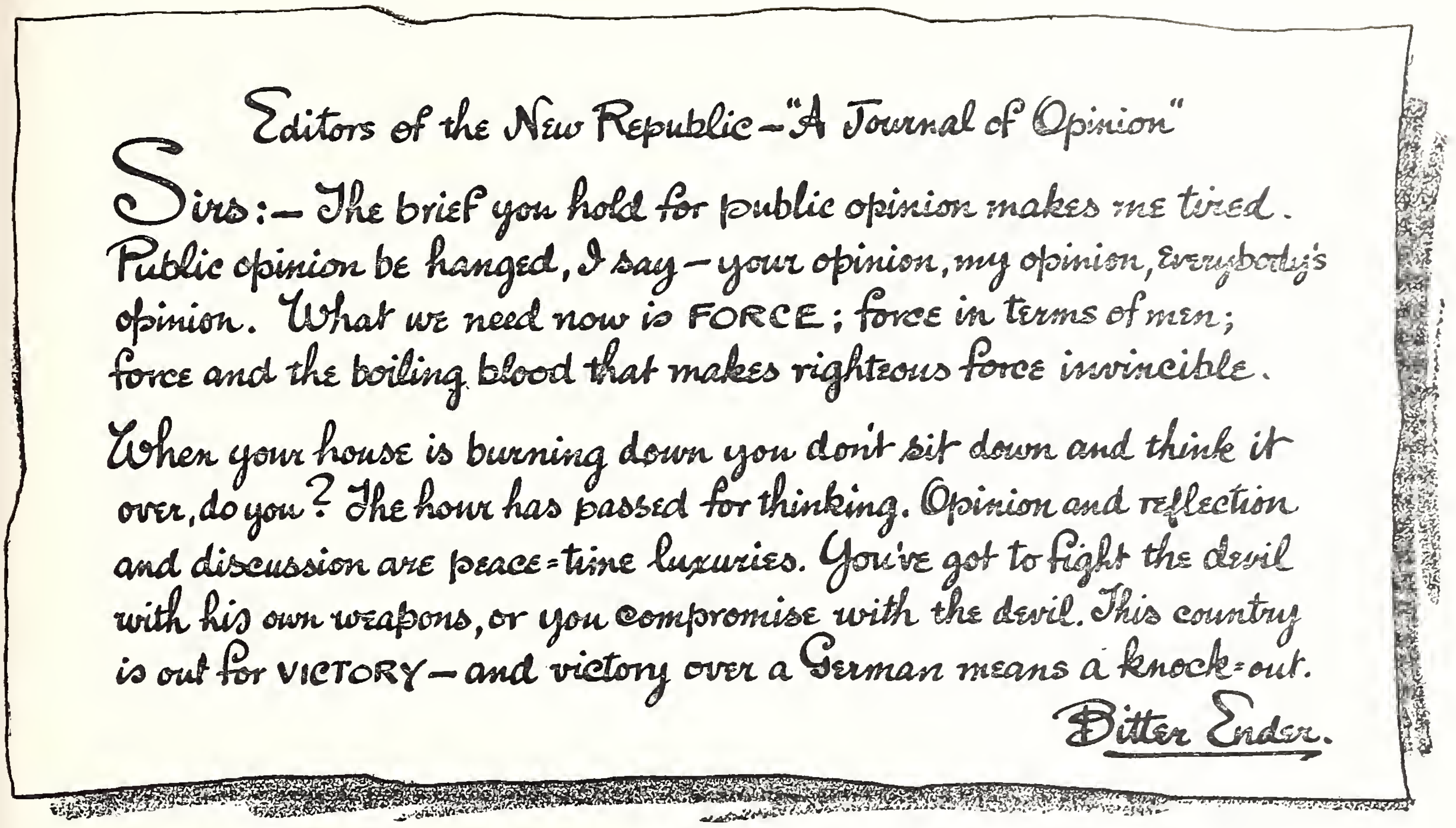
* Printed as Document No. 37A in this pamphlet edition. It should be noted also that the "telegraphic conversation" referred to is taken from an intercepted dispatch which came directly into Mr. Sisson's hands. This, perhaps, was not made clear to the committee.



Editors of the New Republic—"A Journal of Opinion"

Sirs:— The brief you hold for public opinion makes me tired. Public opinion be hanged, I say—your opinion, my opinion, everybody's opinion. What we need now is FORCE; force in terms of men; force and the boiling blood that makes righteous force invincible.

When your house is burning down you don't sit down and think it over, do you? The hour has passed for thinking. Opinion and reflection and discussion are peace-time luxuries. You've got to fight the devil with his own weapons, or you compromise with the devil. This country is out for VICTORY—and victory over a German means a knock-out.

Bitter Ender.

"To Bitter Ender":—

VICTORY—all we are and hope to be is bound up in that word. Attila might have written your letter—or the Kaiser. Your conception of victory is theirs. It is dark with dust of the ages. Trivial and antiquated and unimportant, it could go unchallenged if it were not also just now a little dangerous. Too many good citizens have seized upon it as the last word in victory, and if enough more shall be persuaded to join them, then who shall measure the disaster to a hopeful world? Your conception of victory must go, because if it stands Germany, even when we have defeated her, would be our conqueror.

Any different conception is to you but a covert bid for a premature peace. You are entangled in the delusion that those who disagree with you are somehow against the use of force. Nobody is trying to find a substitute for force. The point is to use our force—every ounce we have, and every kind we have—so as to make sure that what we get by it is what we are after. Bitter Ender, you call yourself—you are no Bitter Ender at all. For you fight, not for an end, but for a finish. You are not even a dweller in Half-way House. For you have not compromised with the devil, you have surrendered to him. You have broken your contract with the spiritual sources of your own democracy: you have fortified and vindicated the gospel of Prussianism by making it your own.

"Public opinion be hanged," you say, and imagine yourself a patriot. This war is being fought because the masters of Germany did that very thing. They hanged public opinion. By an educational system designed to turn out dutiful slaves and efficient masters; by an electoral system designed to perpetuate class rule by a few; by forty years of the most skillful home propaganda the world has ever known—the Prussian Junker has enslaved the will of the German people to Prussianism. Public opinion does not count today in Germany; and the war will not be won until it does.

> *Victory will be ours when, and not until, the Prussian way of thinking shall have been eliminated; when it shall have seen itself as futile and unprofitable as we have seen it base. Victory will be ours when the doctrine of the divine right of might shall have been laid at rest wherever it exists the world over. Victory will be ours when the autocratic psychology of force shall have been supplanted by the democratic psychology of consent; when the politics of force shall have given way to the politics of consent.*

And how is this victory to be achieved? "What we need now is force," you shout, as if you had made a discovery. No one questions the need of force today—force to the utmost, force without stint or limit. But force alone is not enough. Victory will not be ours simply because our force shall have vanquished the Kaiser's. And most surely it will not be ours if we shall have embraced the very faith we set out to destroy.

Yours is the opportunity of centuries, yet you pass it by with scorn. Your "boiling blood" may be indispensable to the soldier in the charge, but it is of little help to that soldier in the counsels of his people at home. What he expects of us is the cool judgment that shall keep his boy and our boys out of the trenches a generation hence. That is our part of the job: to translate his sacrifice into lasting victory. He will attend to the knock-out part of it—of that he has already given the sign. It is up to us to back him up with the power of a rational political purpose.

FOR this war is not only a military war; it is also a political war—a war for the survival of one of two irreconcilable and mutually exclusive ways of thinking. It amounts to the prize fight you conceive it, or the house afire, unless it is a war for democracy. Democracy is a thing that exists in men's minds; you cannot put it away in lavender until the war is over. It is a conception of a way of living; and, like all things vital in this remaking world of ours, it is now in a state of violent flux. You cannot win a war for democracy—for a way of thinking—by refusing to think. The hour has not "passed for thinking"; the hour is at hand when the straightest kind of thinking is imperative. Victory through arms is conditioned upon it. All our action, all our force is sterile and senseless without it.

Men fight best when they believe most. It is the spirit of the Crusader, not his armor, that is invincible. We cannot achieve the ends for which we entered this war by forgetting their existence. We have got to think out what those ends are and may be; we have got to use them as the measure for our every act and judgment; we have got to work for them resolutely and with clear vision—not singly or in spots, but all over and all through.

For the job is not to be done by proxy. No group of men seated at a green-top table in Berlin, or anywhere else, can make the world safe for democracy if we do not know what democracy is. The power those men will have is the power they derive from the people they represent. Their ability to secure a democratic peace depends upon our conception of what a democratic peace is. If the triumph of force in this war is to mean the triumph of ideas, those ideas must first triumph here at home.

It is to the triumph of ideas that the New Republic is dedicated. That is its reason for being—to know the facts, to search out their significance; but above all to build up the stuff of which sound judgments are made. In this process every man and woman must bear an individual part—even Bitter Enders. Any administration of a democracy, but especially this one in world-war time, needs this peculiar support—which is not public approval or public disapproval, but creative public understanding.

There's a cry from Macedonia, Mr. Bitter Ender. Come over and help. We've got to out-think the enemy if we are to out-fight him.

THE
Measure of
VICTORY

a reflection of the liberal
point of view with respect to the war for
the consideration

of

Published by

THE NEW REPUBLIC

in the conviction that a united public opinion
is a primary condition of victory and that
such a state of opinion rests on
common understanding
of common aims

AUGUST
1918

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13

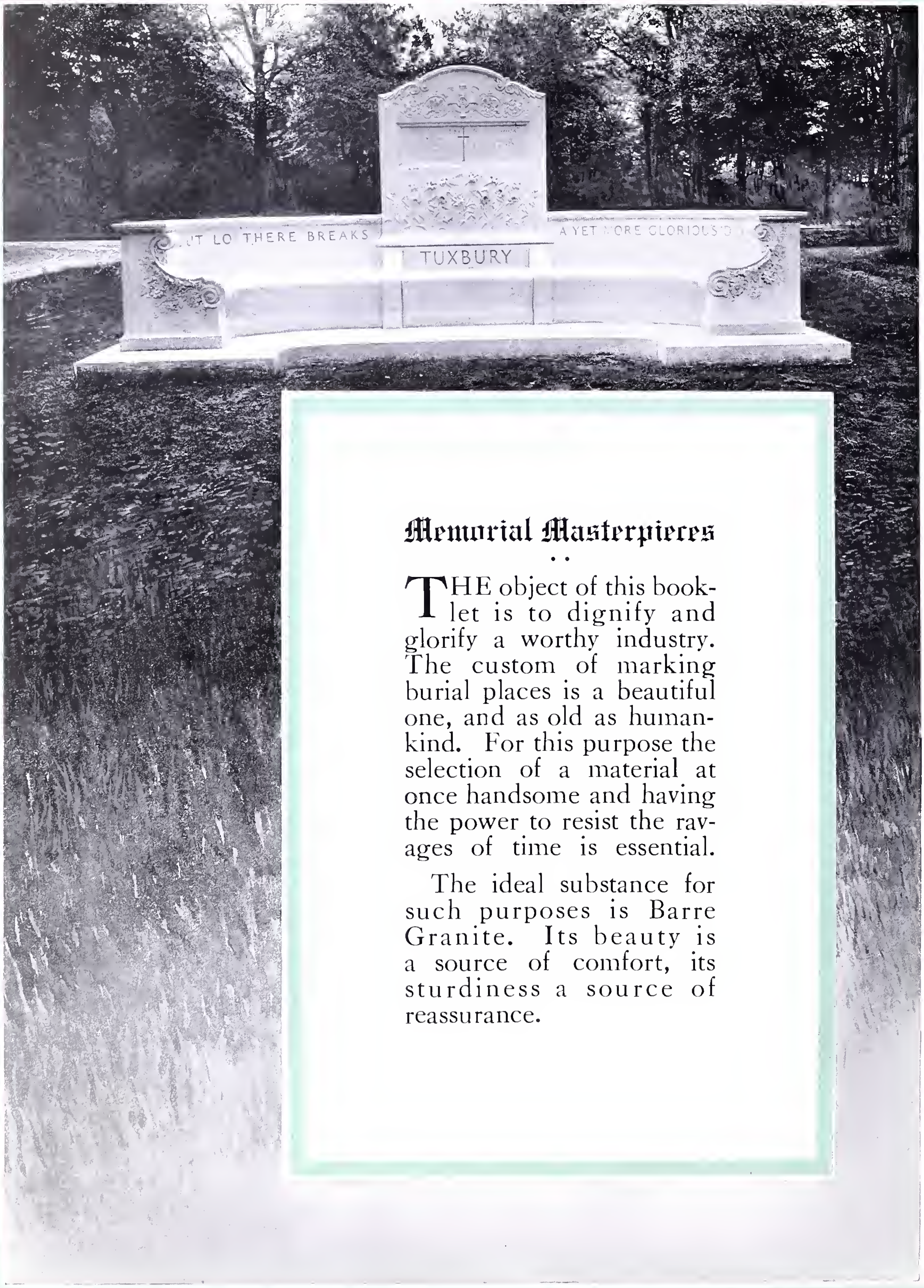
MEMORIAL MASTERPIECES

BARRE GRANITE

MEMORIAL MASTERPIECES
IN
BARRE GRANITE

FROM THE
GRANITE
CENTRE OF
THE WORLD

BARRE QUARRIERS
AND MANUFACTURERS
ASSOCIATION
BARRE - VERMONT

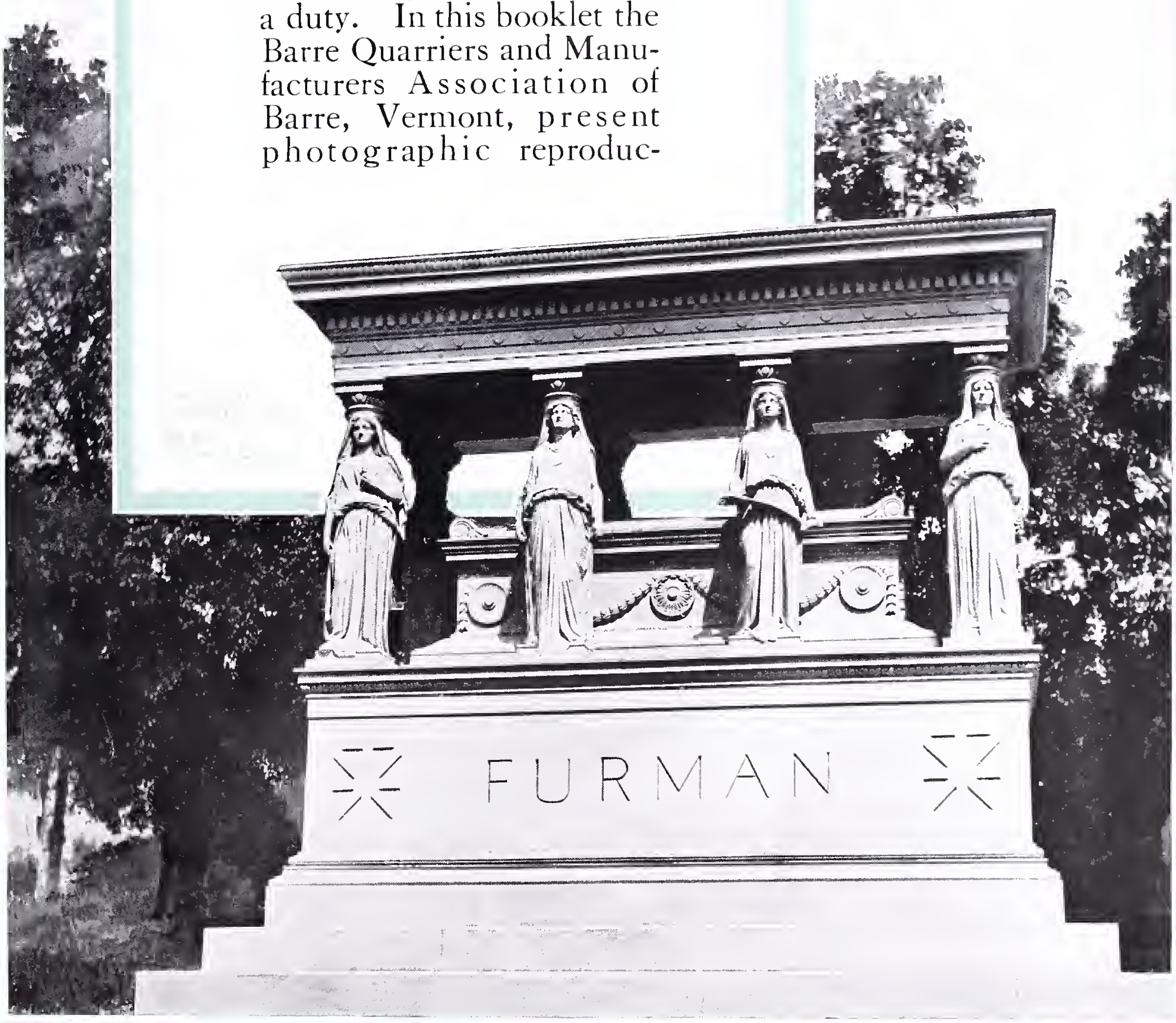


Memorial Masterpieces

THE object of this booklet is to dignify and glorify a worthy industry. The custom of marking burial places is a beautiful one, and as old as humankind. For this purpose the selection of a material at once handsome and having the power to resist the ravages of time is essential.

The ideal substance for such purposes is Barre Granite. Its beauty is a source of comfort, its sturdiness a source of reassurance.

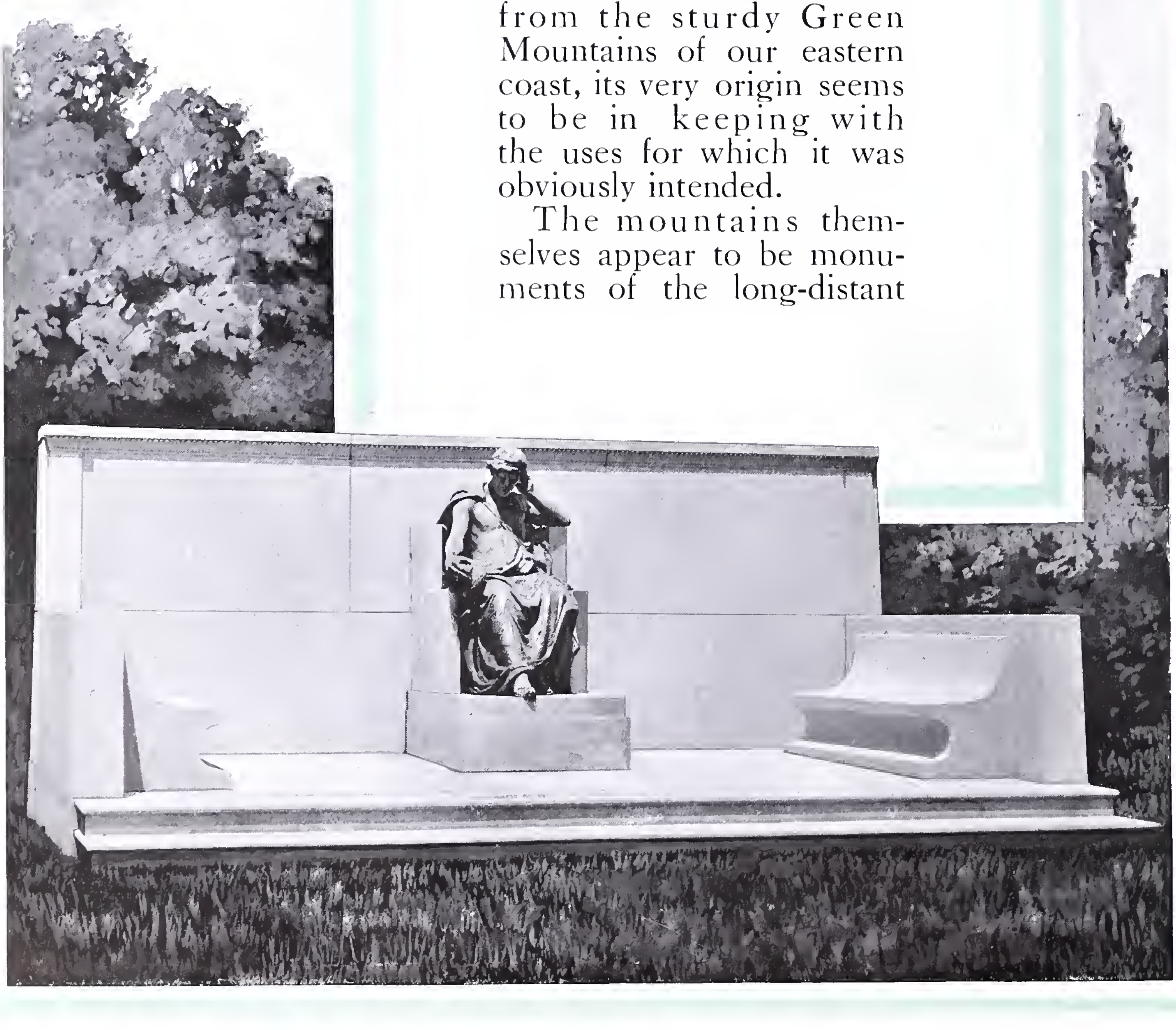
The marking of the resting place of the departed is a sacred privilege. The erection of a suitable monument should be one of your duties instead of being left to the others. Surely the erection of the most suitable material with which to meet these obligations is in itself a duty. In this booklet the Barre Quarriers and Manufacturers Association of Barre, Vermont, present photographic reproduc-

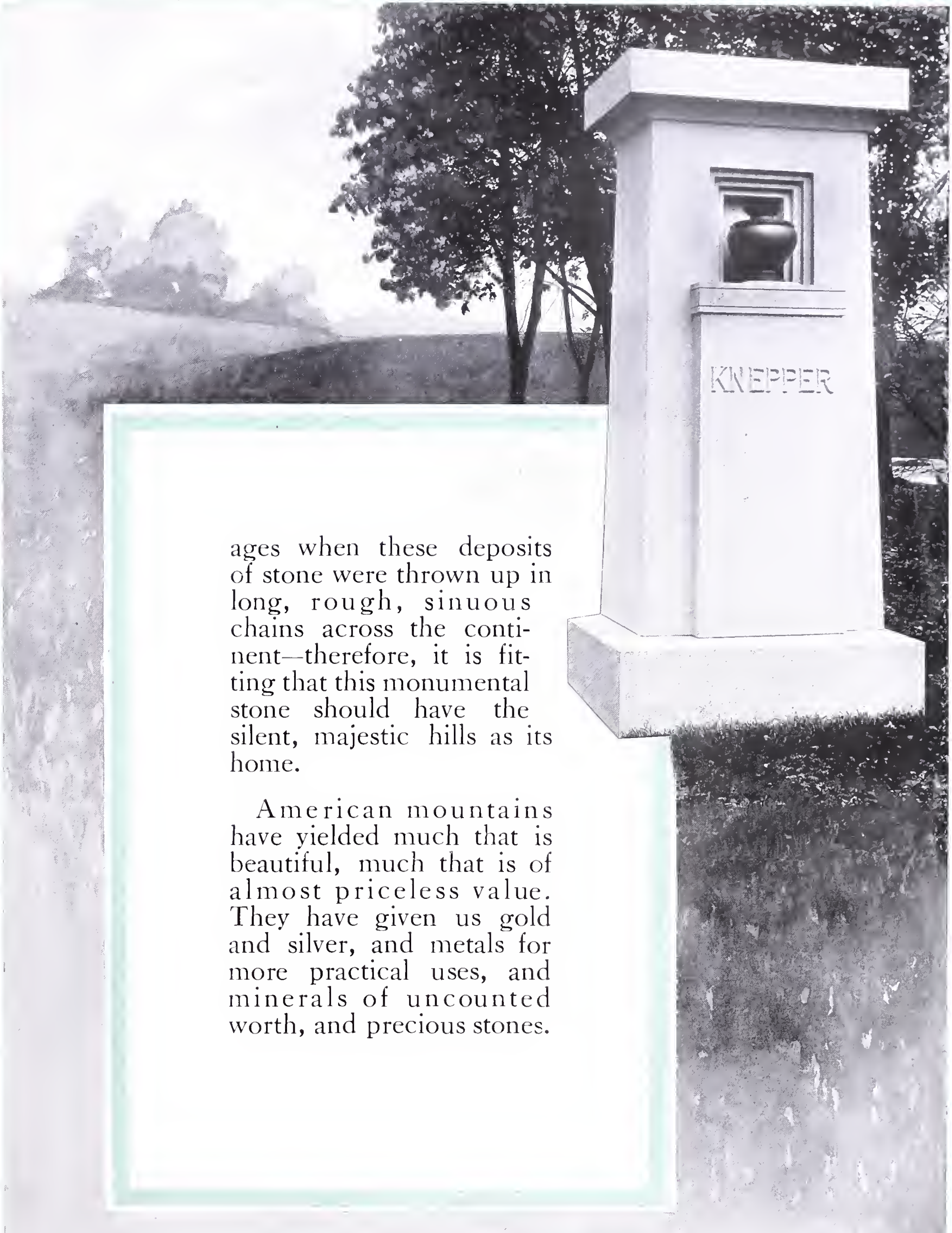


tions of some of the magnificent monuments that have been cut from Barre Granite, also a faithful description of the beautiful rock from which they are carved.

Barre Granite is one of the wonderful results of the workings of the forces of Nature. Coming as it does from the sturdy Green Mountains of our eastern coast, its very origin seems to be in keeping with the uses for which it was obviously intended.

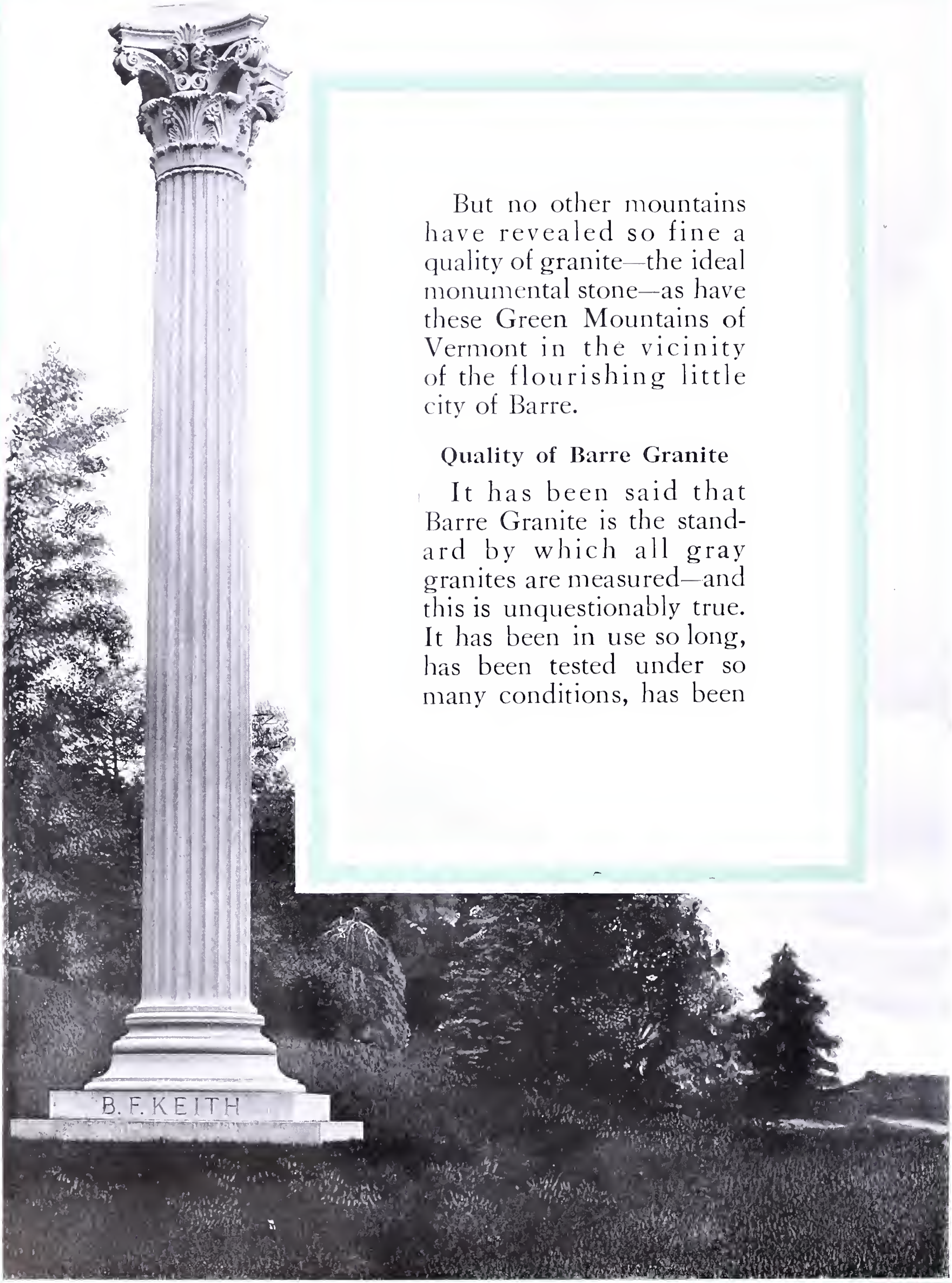
The mountains themselves appear to be monuments of the long-distant





ages when these deposits of stone were thrown up in long, rough, sinuous chains across the continent—therefore, it is fitting that this monumental stone should have the silent, majestic hills as its home.

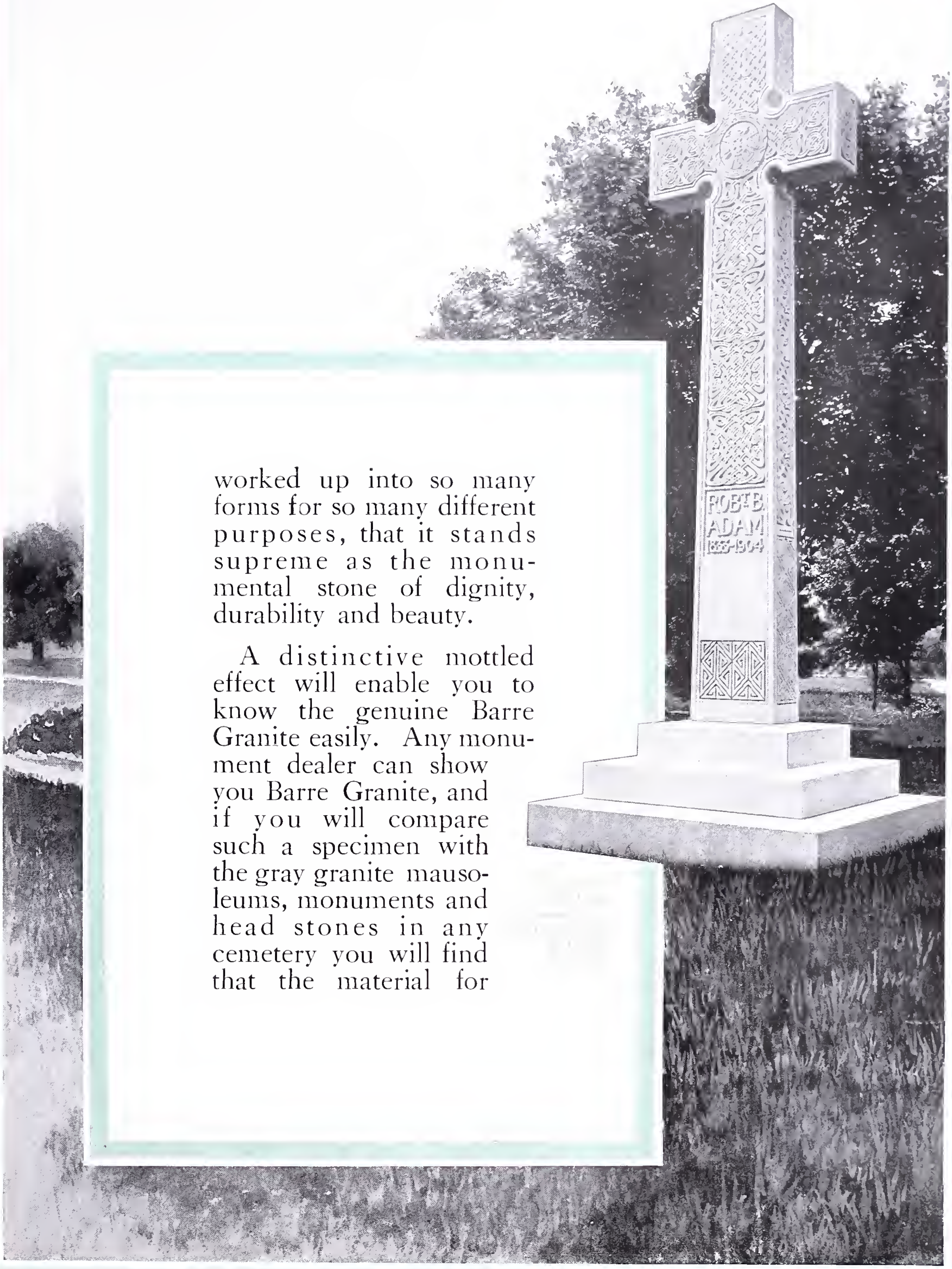
American mountains have yielded much that is beautiful, much that is of almost priceless value. They have given us gold and silver, and metals for more practical uses, and minerals of uncounted worth, and precious stones.



But no other mountains have revealed so fine a quality of granite—the ideal monumental stone—as have these Green Mountains of Vermont in the vicinity of the flourishing little city of Barre.

Quality of Barre Granite

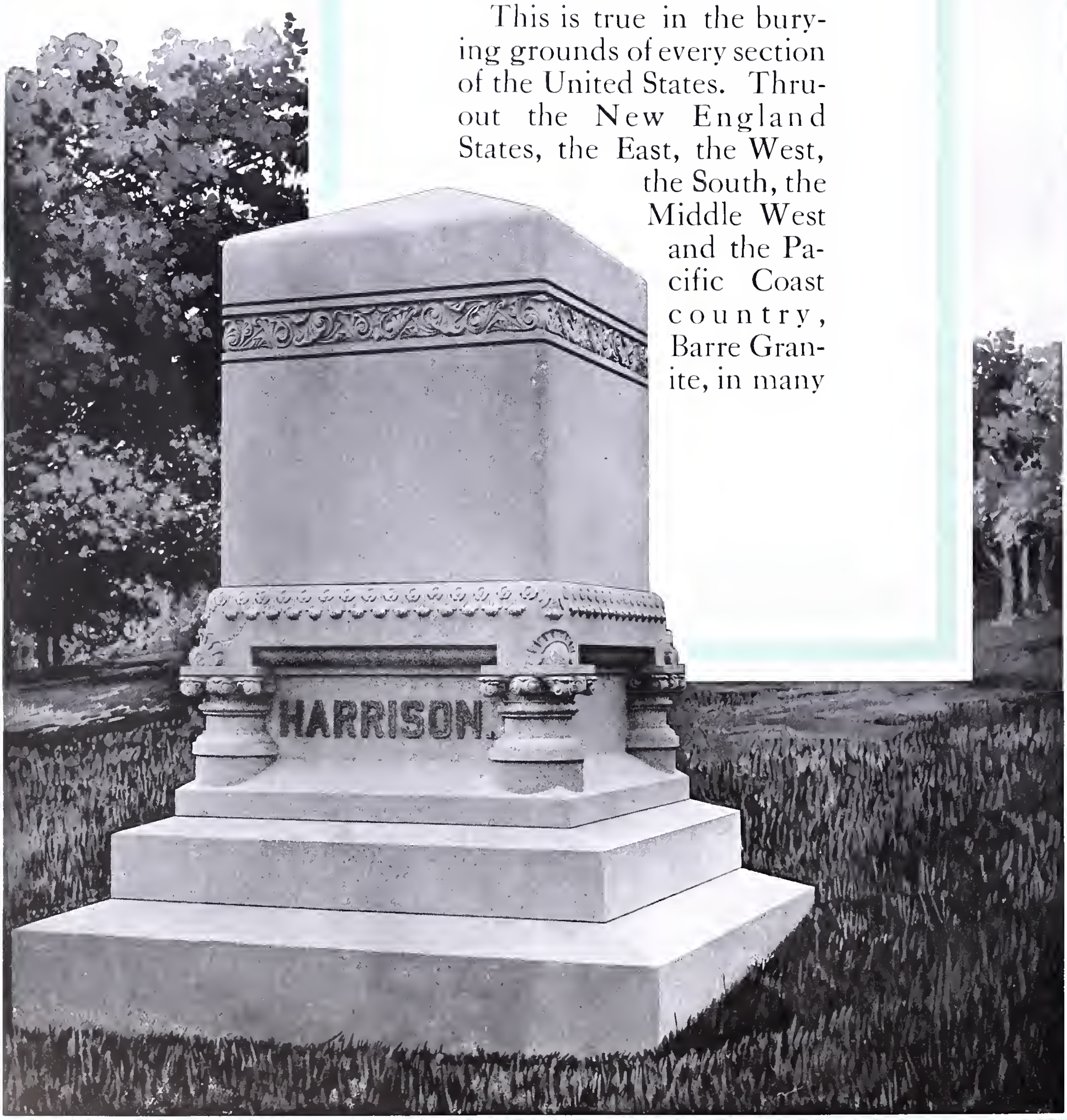
It has been said that Barre Granite is the standard by which all gray granites are measured—and this is unquestionably true. It has been in use so long, has been tested under so many conditions, has been



worked up into so many forms for so many different purposes, that it stands supreme as the monumental stone of dignity, durability and beauty.

A distinctive mottled effect will enable you to know the genuine Barre Granite easily. Any monument dealer can show you Barre Granite, and if you will compare such a specimen with the gray granite mausoleums, monuments and head stones in any cemetery you will find that the material for from eighty to ninety per cent of them comes from the Barre, Vermont, quarries.

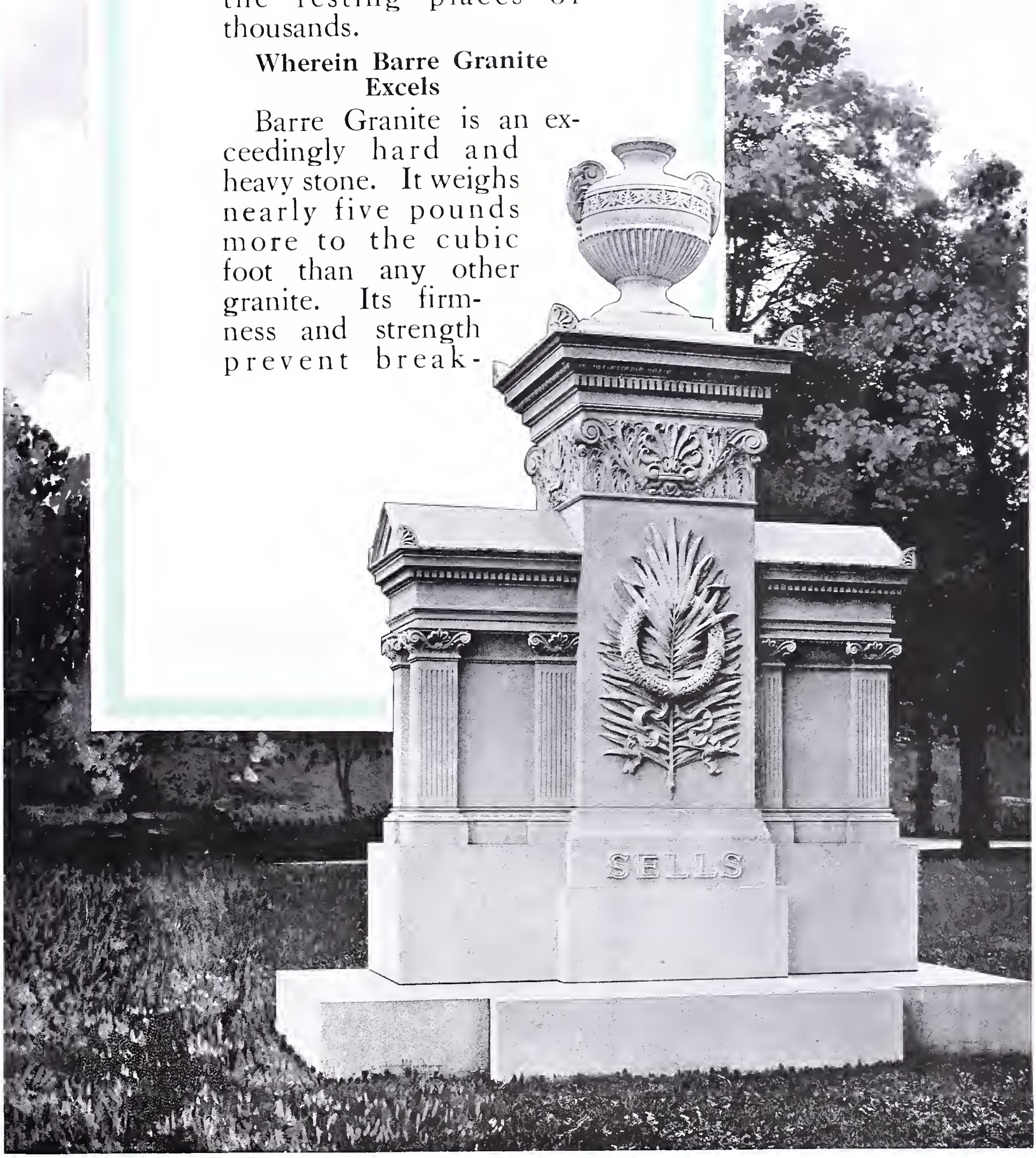
This is true in the burying grounds of every section of the United States. Thruout the New England States, the East, the West, the South, the Middle West and the Pacific Coast country, Barre Granite, in many



forms, stands sentinel over the resting places of thousands.

Wherein Barre Granite Excels

Barre Granite is an exceedingly hard and heavy stone. It weighs nearly five pounds more to the cubic foot than any other granite. Its firmness and strength prevent break-



age in process of cutting, shipping or erecting. Delicate carvings are not easily broken or chipped. It is indeed the *enduring* stone —the *rock everlasting*.

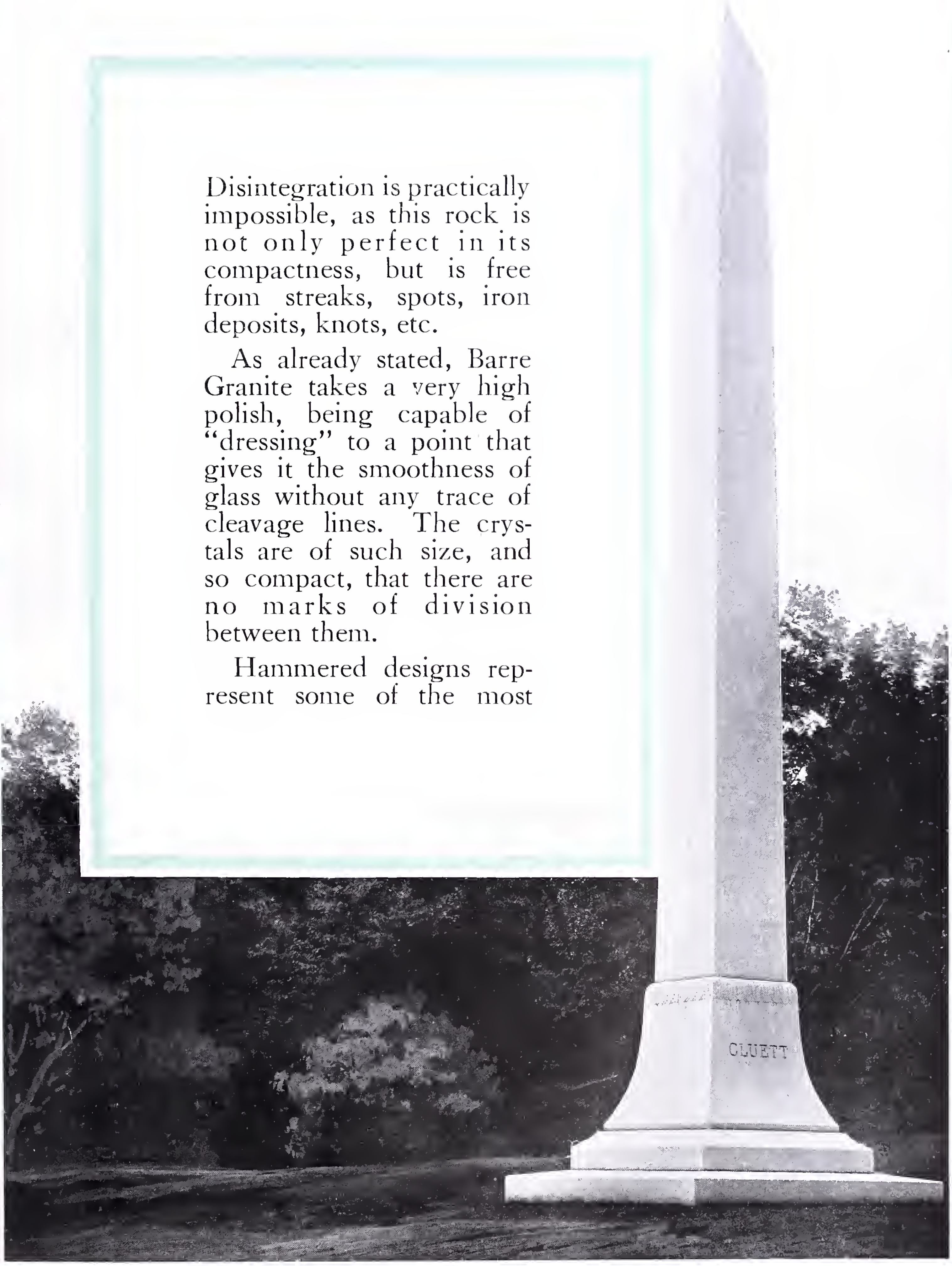
Barre Granite has a fine-grained, crystalline texture. This is not so pronounced as to interfere with its rich color, yet the stone lends itself perfectly to the requirements of high polishing and delicate inscriptions and decorations.

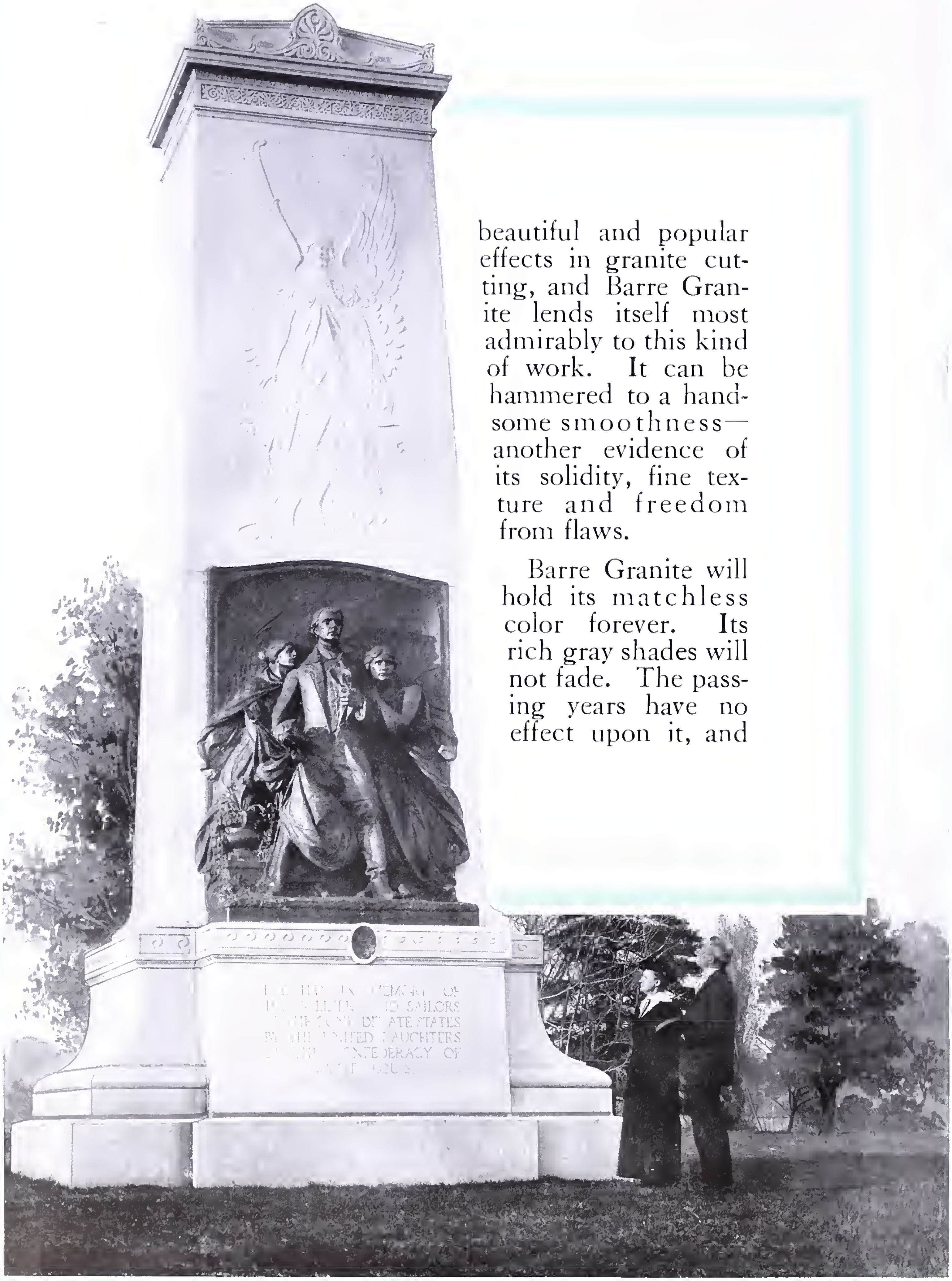
The texture of Barre Granite gives it the greatest possible resistance to the action of the weather.

Disintegration is practically impossible, as this rock is not only perfect in its compactness, but is free from streaks, spots, iron deposits, knots, etc.

As already stated, Barre Granite takes a very high polish, being capable of "dressing" to a point that gives it the smoothness of glass without any trace of cleavage lines. The crystals are of such size, and so compact, that there are no marks of division between them.

Hammered designs represent some of the most

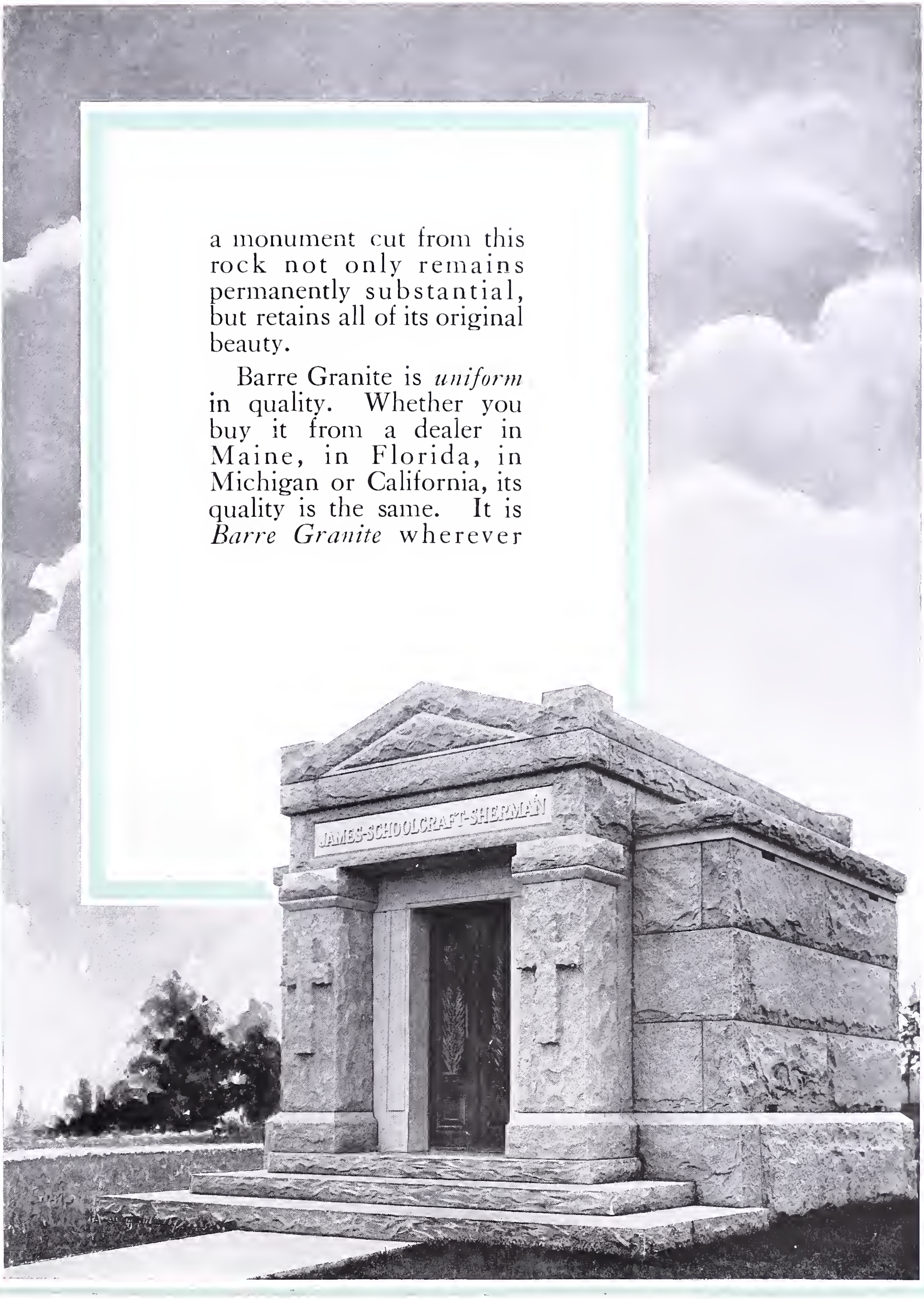




beautiful and popular effects in granite cutting, and Barre Granite lends itself most admirably to this kind of work. It can be hammered to a handsome smoothness—another evidence of its solidity, fine texture and freedom from flaws.

Barre Granite will hold its matchless color forever. Its rich gray shades will not fade. The passing years have no effect upon it, and a monument cut from this rock not only remains permanently substantial, but retains all of its original beauty.

Barre Granite is *uniform* in quality. Whether you buy it from a dealer in Maine, in Florida, in Michigan or California, its quality is the same. It is *Barre Granite* wherever



you find it, and that means superlative excellence for all its uses. Barre Granite has been quarried on a large scale for more than forty years, and this length of service in cemeteries thruout the country—a large percentage of it being used for monuments—has demonstrated its superiority over all other

stones used for such purposes.

Two Colors of Barre Granite

There are two shades of Barre Granite—the bluish gray of Barre Dark and the grayish white of Barre Light. The difference is due to the presence of a greater number of small black crystals in the dark granite.

Dark Barre Granite lends itself perfectly to high polishing, the deep rich color and grain being brought out perfectly under such treatment.

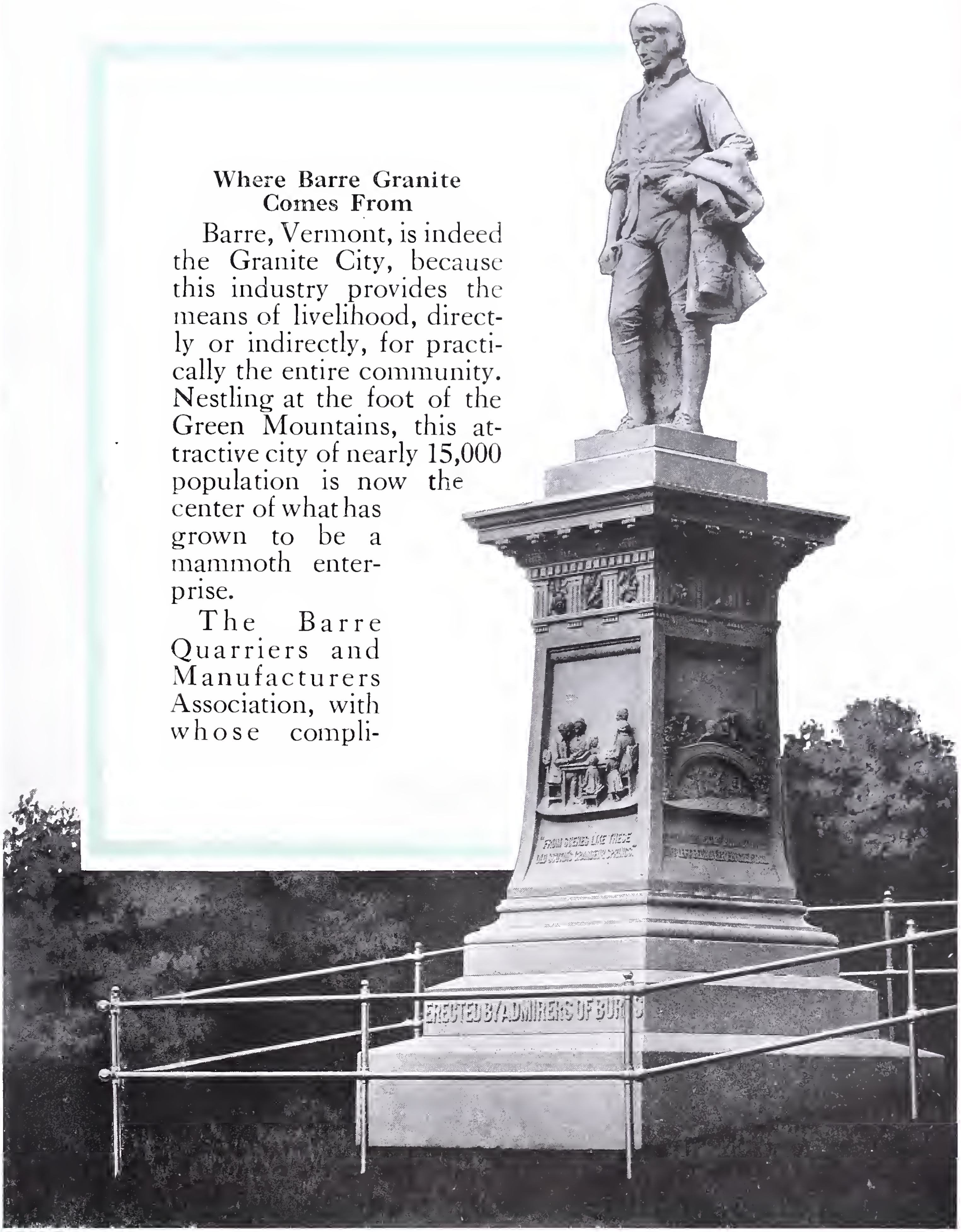
Light Barre Granite is used almost entirely for fine hammered work. The light color is of great demand because of its adaptability to hammered finish, as well as rock face work, while the Dark Granite is most popular for polished work.

The quality of the Dark Granite is the same as that of the Light Granite—both are equally superior to other granites.

Where Barre Granite Comes From

Barre, Vermont, is indeed the Granite City, because this industry provides the means of livelihood, directly or indirectly, for practically the entire community. Nestling at the foot of the Green Mountains, this attractive city of nearly 15,000 population is now the center of what has grown to be a mammoth enterprise.

The Barre Quarriers and Manufacturers Association, with whose compli-


"FROM SCENES LIKE THESE OLD SCOTIA'S GRANDEUR SPRINGS."
ERECTED BY ADMIRERS OF BURNS

ments this booklet is presented, is composed of quarry owners and manufacturers of Barre Granite products, every ton of rock handled by them coming from a district approximately three and a half miles long and one mile wide and embracing a chain of modest peaks in this picturesque mountain range.

The fact that granite of equal quality has not been found in any other spot in the country, or, indeed, in the world, means that the most skilled artisans in stone cutting have been attracted to this place. Here are found thousands of cutters and sculptors, each one proficient in his particular specialty. The most rugged specimens—huge monoliths for various uses—are shaped in some of the more than a score of cutting sheds in Barre,

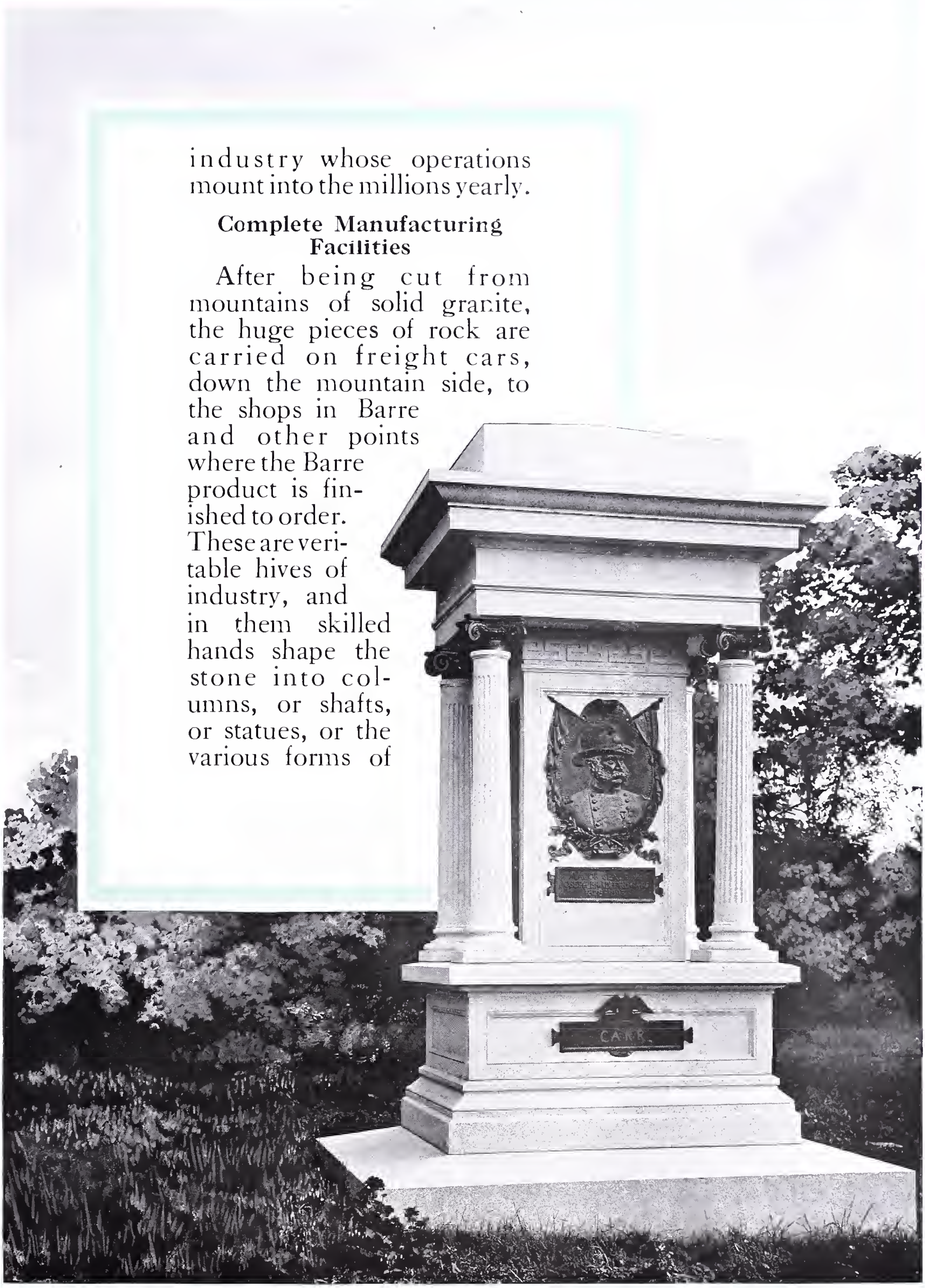
while the most delicate carvings are executed in others.

Naturally, the best raw product and the largest number of firms dealing in that product have attracted the foremost experts in this line, with the result that the New England town where, about half a century ago, the granite taken from nearby hills was used only in making millstones and for other humble purposes, is now the center of an

industry whose operations mount into the millions yearly.

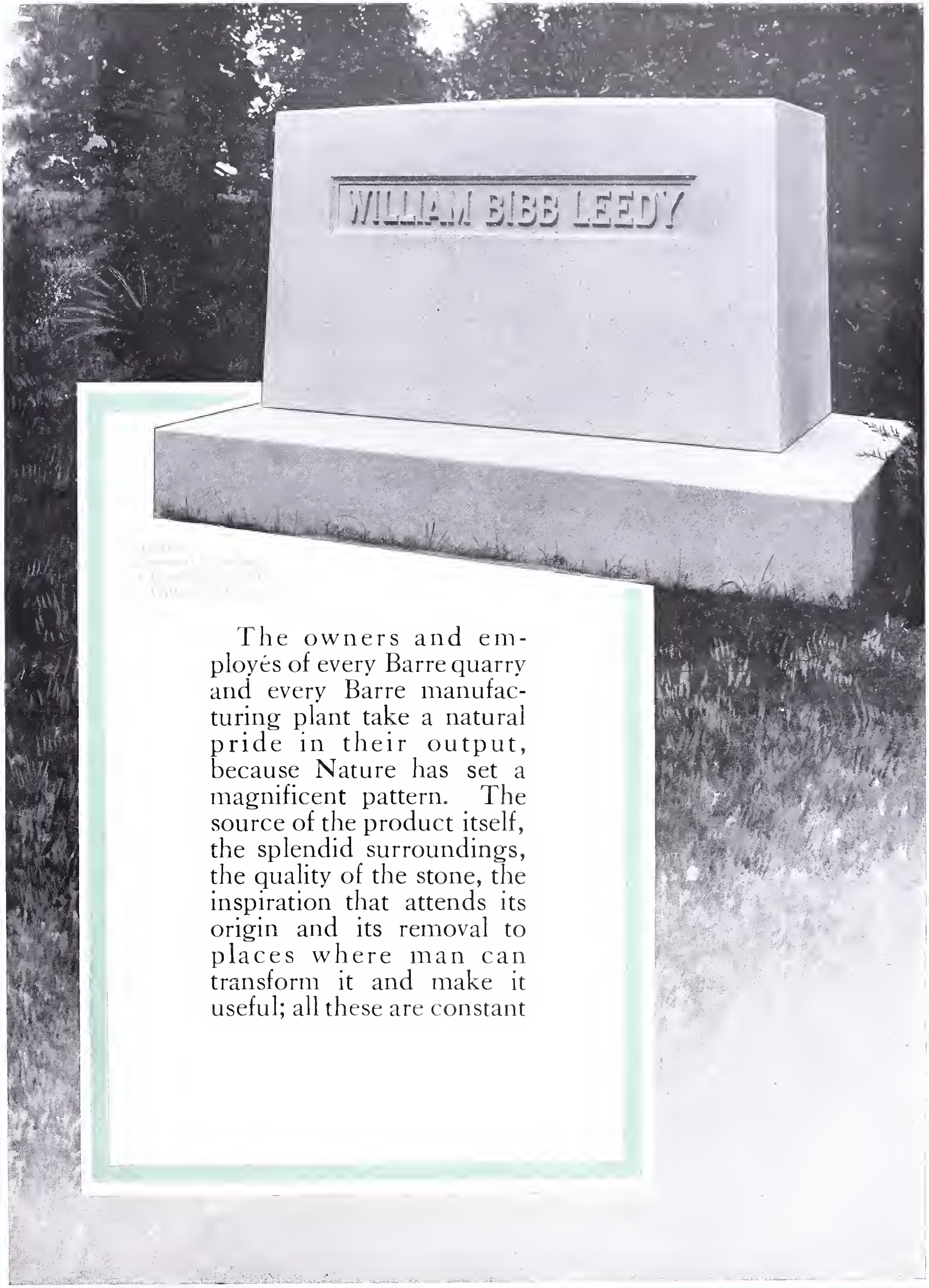
Complete Manufacturing Facilities

After being cut from mountains of solid granite, the huge pieces of rock are carried on freight cars, down the mountain side, to the shops in Barre and other points where the Barre product is finished to order. These are veritable hives of industry, and in them skilled hands shape the stone into columns, or shafts, or statues, or the various forms of



mausoleums, monuments, tomb stones and markers.

In these shops the latest power machinery is used. Compressed air surfacing machines, huge electric derricks that lift a rock weighing a hundred tons as easily as a child would pluck a flower, polishing machines that grind immense surfaces until they shine like mirrors, air chisels that cut designs and letters more accurately than they could be done by the old hand method—all these go to make the equipment found in the many establishments that have made Barre famous the world over.



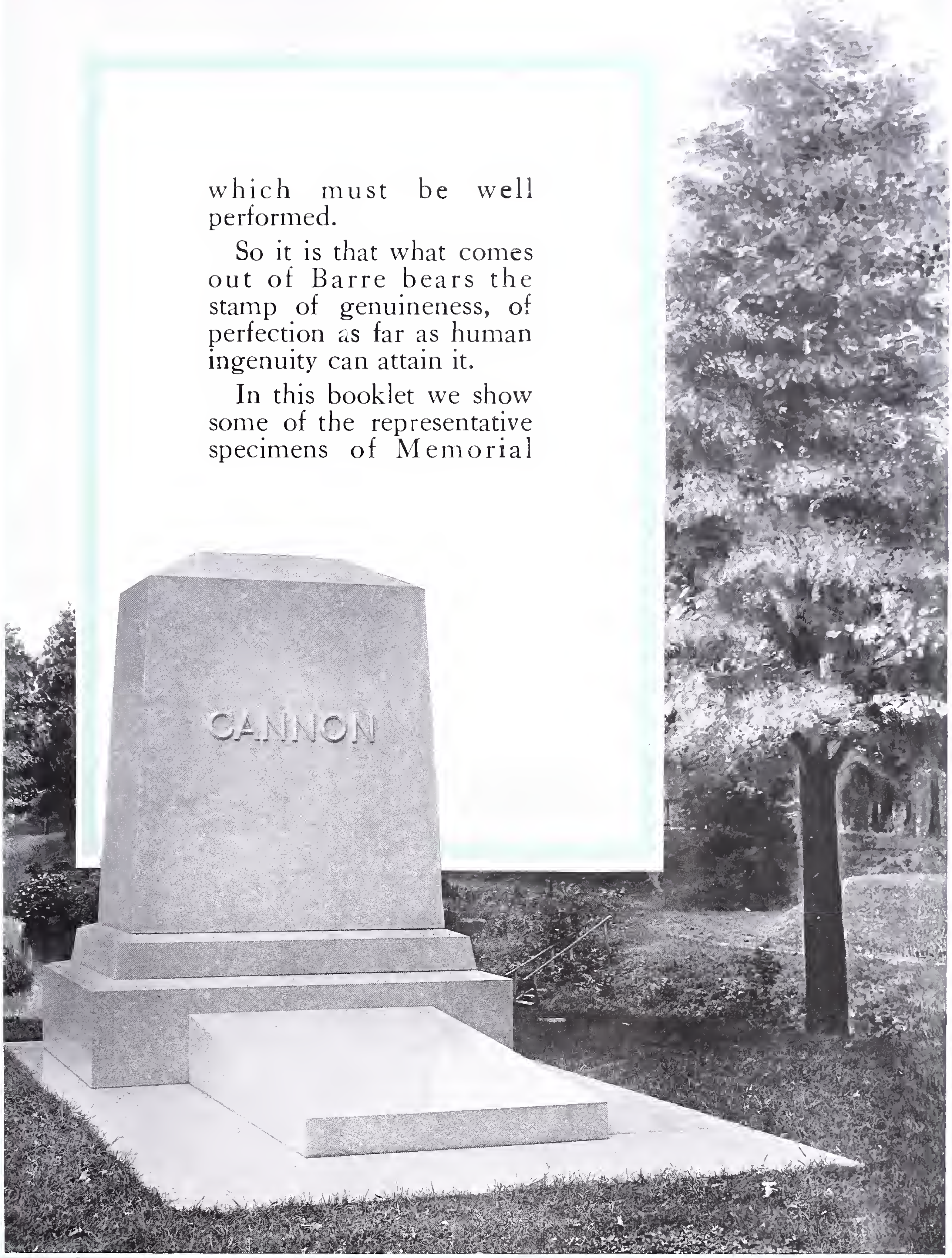
The owners and employés of every Barre quarry and every Barre manufacturing plant take a natural pride in their output, because Nature has set a magnificent pattern. The source of the product itself, the splendid surroundings, the quality of the stone, the inspiration that attends its origin and its removal to places where man can transform it and make it useful; all these are constant incentives to the completion of a marketable output of the best possible grade.

In Barre there is a constant stimulus for doing things well. Knowing the locality's reputation as the greatest of all granite centers; knowing that the evidences of Barre's importance are to be found in large numbers in practically every burying ground thruout the land, the ones responsible for the industry feel the weight of a duty

which must be well performed.

So it is that what comes out of Barre bears the stamp of genuineness, of perfection as far as human ingenuity can attain it.

In this booklet we show some of the representative specimens of Memorial



Masterpieces cut from Barre Granite. These illustrations will show you that Barre Granite is equally good for the most expensive mausoleums or the inexpensive marker. No matter what use it may be put to, it is the Rock Beautiful, the Rock Everlasting, the most appropriate material for memorials of any kind.

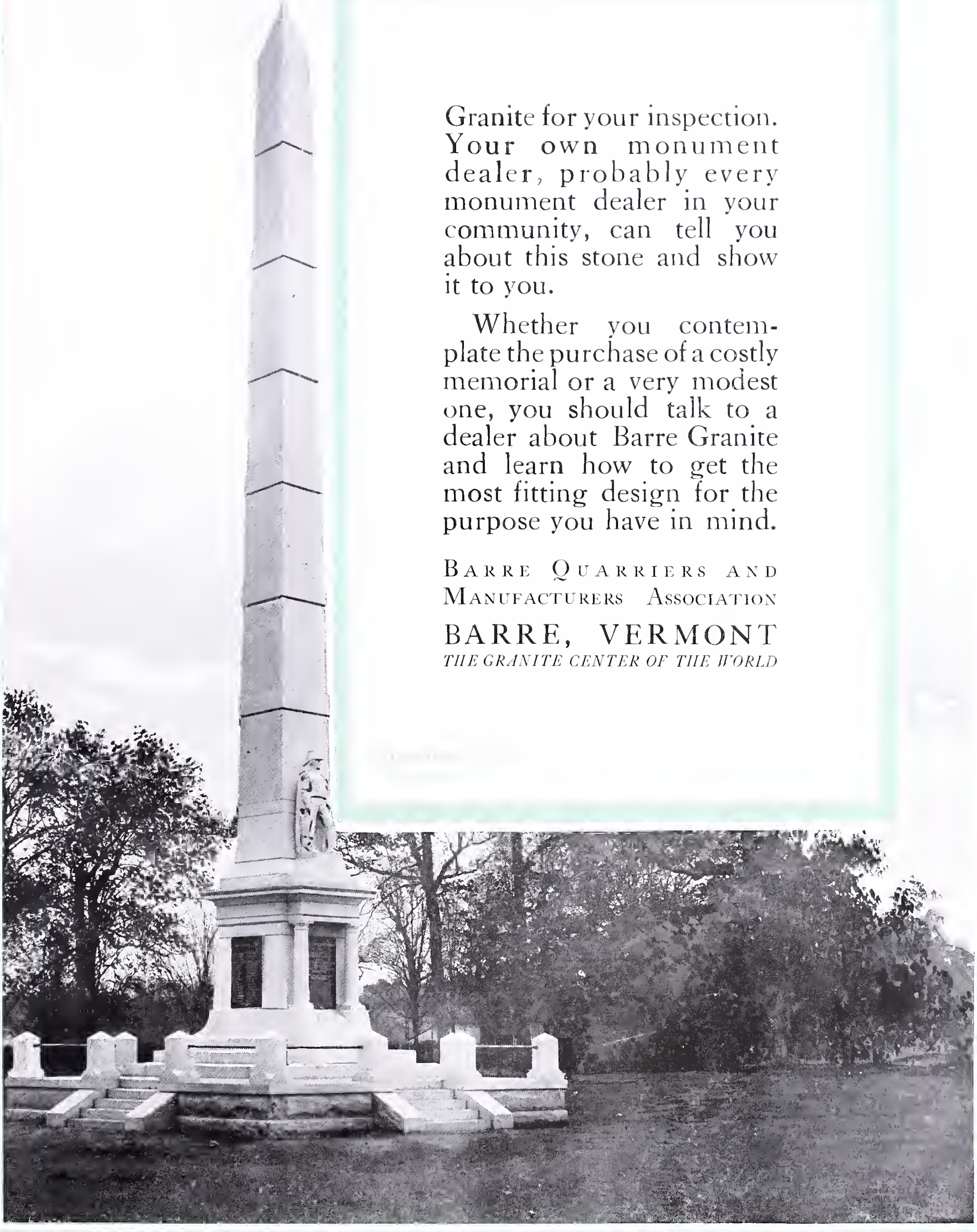
You Can See It Anywhere

It is not difficult for you to find specimens of Barre

Granite for your inspection. Your own monument dealer, probably every monument dealer in your community, can tell you about this stone and show it to you.

Whether you contemplate the purchase of a costly memorial or a very modest one, you should talk to a dealer about Barre Granite and learn how to get the most fitting design for the purpose you have in mind.

Barre Quarriers and
Manufacturers Association
BARRE, VERMONT
THE GRANITE CENTER OF THE WORLD



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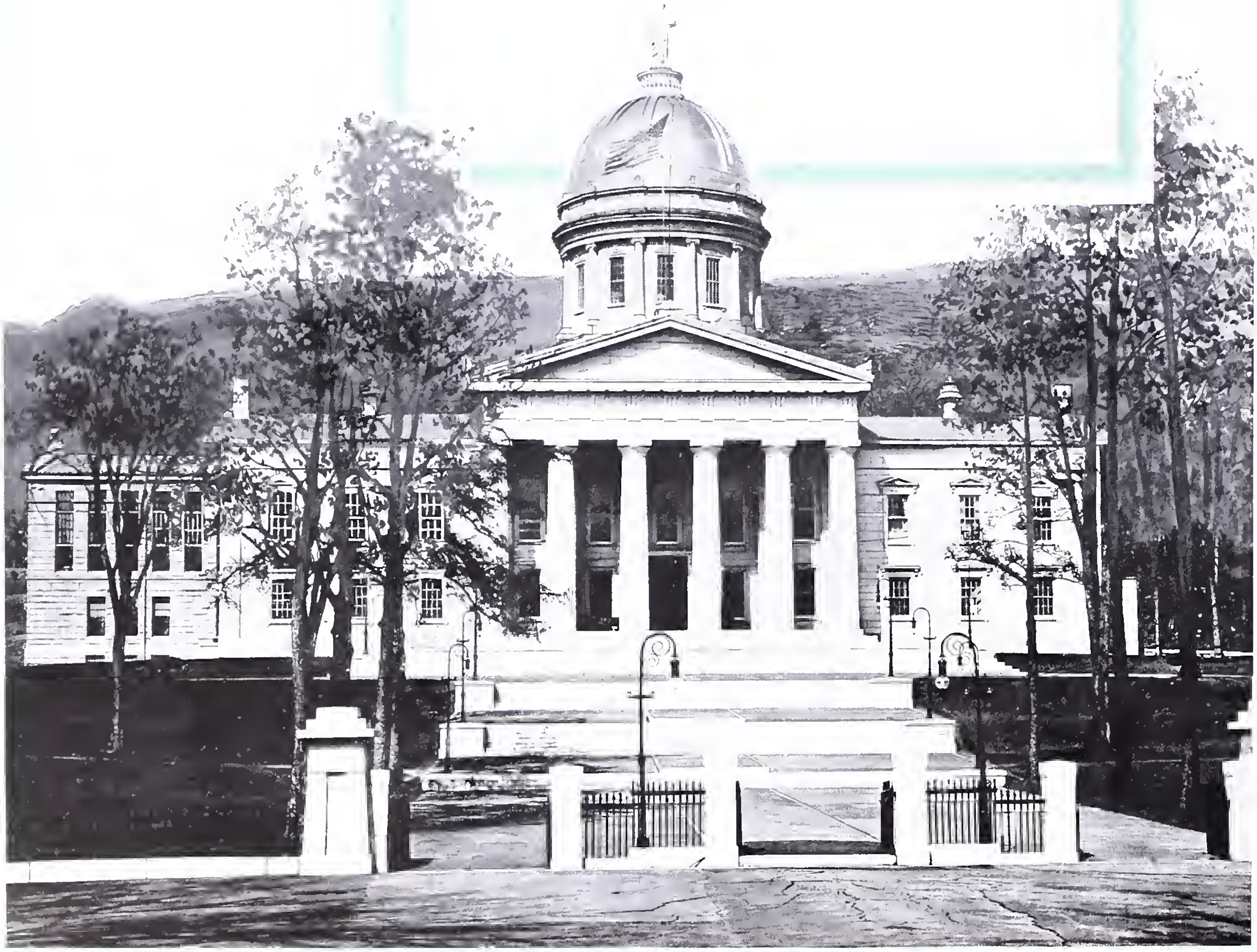

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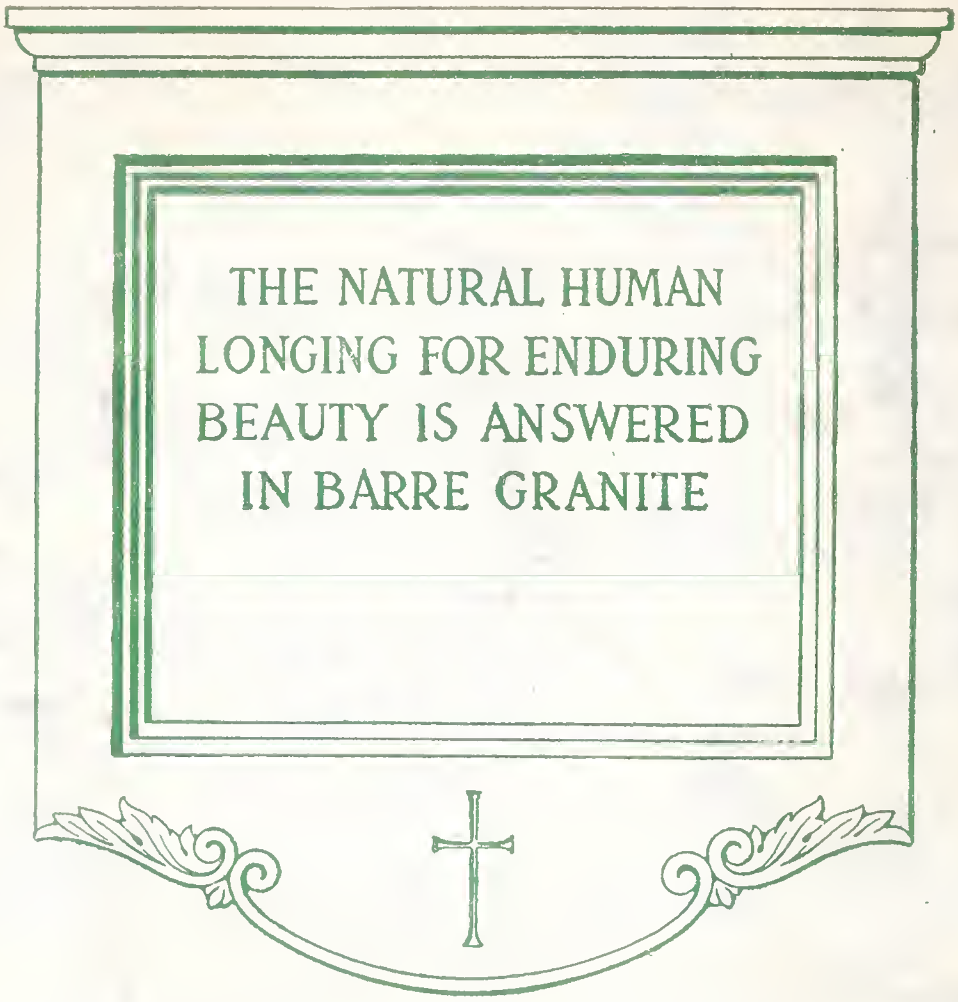

THE NATURAL HUMAN
LONGING FOR ENDURING
BEAUTY IS ANSWERED
IN BARRE GRANITE

14

THE ZONING SYSTEM

REPRINTED FROM
PROCEEDINGS OF THE
ENGINEERS' CLUB OF PHILADELPHIA
FOR APRIL 1917

Philadelphia Zoning Commission

ROOM 216 CITY HALL
PHILADELPHIA

EXPLANATION

The subject discussed in the attached pamphlet is one of extreme interest and vitally concerns all citizens. The question of proper and reasonable regulations governing the height, use and area of buildings and the districting of the City to safeguard both private and public interests is rapidly becoming imperative. Many cities have begun the serious consideration of this problem and several have established and are enforcing such regulations. In New York within the last few years conditions due to unregulated growth had become extremely acute, and the attached pamphlet sets forth the measures taken there to meet these conditions and the reasons for such measures.

The situation in Philadelphia has not reached but is rapidly approaching the proportions attained in New York. In view of this fact, to provide for future contingencies, to protect existing property, and to eliminate by timely action the cost of expensive rearrangement and reconstruction, there was passed by the State Legislature in May, 1915, an Act authorizing cities of the first-class to regulate the location, size and use of buildings and to make different regulations for different districts. In conformity with this, a resolution of Councils was passed July 20, 1916, authorizing the Mayor to appoint a Commission to make the necessary studies, to suggest governing regulations and legislation and to establish the boundaries of districts. This Commission, consisting of certain City officials and representatives from various civic organizations, was thereupon appointed, immediately organized and started upon its labors.

A thorough study of zoning progress in other cities was first inaugurated, valuable advice and assistance being received from the City of New York, the result of whose investigations was of extreme value. An examination of the legal aspects of the problem has been made, and many judicial decisions, including several from the Supreme Court of the United States, indicate a favorable attitude on the part of the courts toward the establishment and enforcement of reasonable regulations.

In order to intimately and thoroughly understand the conditions existing in Philadelphia, a Committee on Surveys was appointed which, in conjunction with the Advisory Engineer specially attached to it, has begun an exhaustive study of conditions existing in Philadelphia relative to the heights of buildings, the area of open space in proportion to that covered by buildings, and the location of industries, businesses and residences. The Committee is now engaged in this work, and it is anticipated that a preliminary report covering the intent of the proposed regulations and the benefit to be derived from them will be issued at an early date.

The attached pamphlet, which is commended to your earnest consideration, contains the various addresses delivered at a special meeting of the Engineers' Club of Philadelphia, devoted to zoning and districting. Hon. Edward M. Bassett, Chairman of the Heights of Buildings Commission and of the Committee on Building Districts and Restrictions, and Mr. George B. Ford, Consulting Engineer, New York City, have been intimately connected with the zoning movement in New York, and it is largely through their efforts that a satisfactory solution of New York's problems has been assured.

PHILADELPHIA ZONING COMMISSION

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The Zoning System*

WHAT is done in one city is not usually a pattern for another city, and the work in limiting building heights and in zoning in New York City will not, in every particular, apply to a great round city like Philadelphia. Congestion in New York City is affected by its geography, the East and Hudson Rivers, bounding Manhattan on either side, having confined the growth of the city.

What was the problem confronting New York City? The skyscrapers were a considerable part of that problem. A building could be put up to any height, of any form, and cover the entire lot, regardless of the rights of neighbors or whether such a building rendered surrounding plots incapable of being improved by useful buildings or not. Buildings were erected to twenty and more stories in height, making the streets dark, so that artificial light had to be used along the narrower streets to the height of ten and twelve stories. It grew to be the fact that offices in the tall buildings could be rented better near the top, the lower floors being less and less desirable. The greatest evils were the making of "canyon" streets, the overcrowding of certain localities, and the stealing of light and air from one's neighbors. If in any block the first builder can erect a building to any height he chooses on the side lines, and can open his windows on those lines, the land adjoining has had its light absorbed. If any adjoining owner then puts up an equally high building on his property line, the rooms are dark, and, although he may have ruined the first building, he will himself be harmed, and there is no satisfaction to either.

HON. EDWARD M. BASSETT, ESQ.
CHAIRMAN, HEIGHTS OF BUILDING COMMISSION AND OF COMMITTEE ON BUILDING DISTRICTS AND RESTRICTIONS, NEW YORK CITY

Over and over again it has happened in New York City that the first building having windows overlooking the adjoining unbuilt-on lot earned high rentals by reason of having the benefit of good light and air, yet, as soon as other buildings were erected on the vacant lots adjoining, the earning power of the first building decreased until to-day some of the poorest investments are the skyscrapers. There has been a great deal of misapprehension as to the earning power of skyscrapers in New York City. The increased cost of building them necessitates an investment constantly demanding more income to cover the increase in fixed charges. Elevators have to be built in gangs so that the upper stories may have suitable elevator service. The result is that some of the largest buildings in New York City are, as one architect has expressed it, "little more than gangs of elevators surrounded with a shell of offices." Many office buildings in Greater New York do not pay more than two and one-half or three per cent. on the investment.

The problem, however, was not limited to office buildings of the skyscraper class. Congestion from large tenement houses through the Harlem district along the backbone of Manhattan Island and extending across the Williamsburg Bridge into Brooklyn was another phase of it. In fact, the problem included even more than the congestion of tenements. A glue or chemical factory would invade almost any part of the city, driving away the surrounding residents and preventing buildings of the better class being built in such localities. The sporadic tenement house went up in detached-house or block-house localities, exploiting a neighborhood that had been built up under private restrictions. A premature tenement in an outlying district will often rent well, due to attractive suburban surroundings. It actually grew to be the case in New York City that a man was highly speculative who would erect a dwelling house costing over $30,000 or $40,000, because he had no assurance as to what, in the future, would come into the neighborhood or what would be built on his side lines. Residents, therefore, moved away to Long Island, or New Jersey, or Westchester County, to build first-class homes.

Fifth Avenue, the great retail street of the city, was gradually invaded by unsuitable uses. There was no limit to the heights of buildings. Owners on lower Fifth Avenue could erect a building fifteen, or even twenty-five, stories high and earn a better return than on a building of fewer stories. Up such tall buildings went until, finally, enough tenants could not be secured to fill them. People in the garment-making business were attracted to such buildings in such localities because there were lofts

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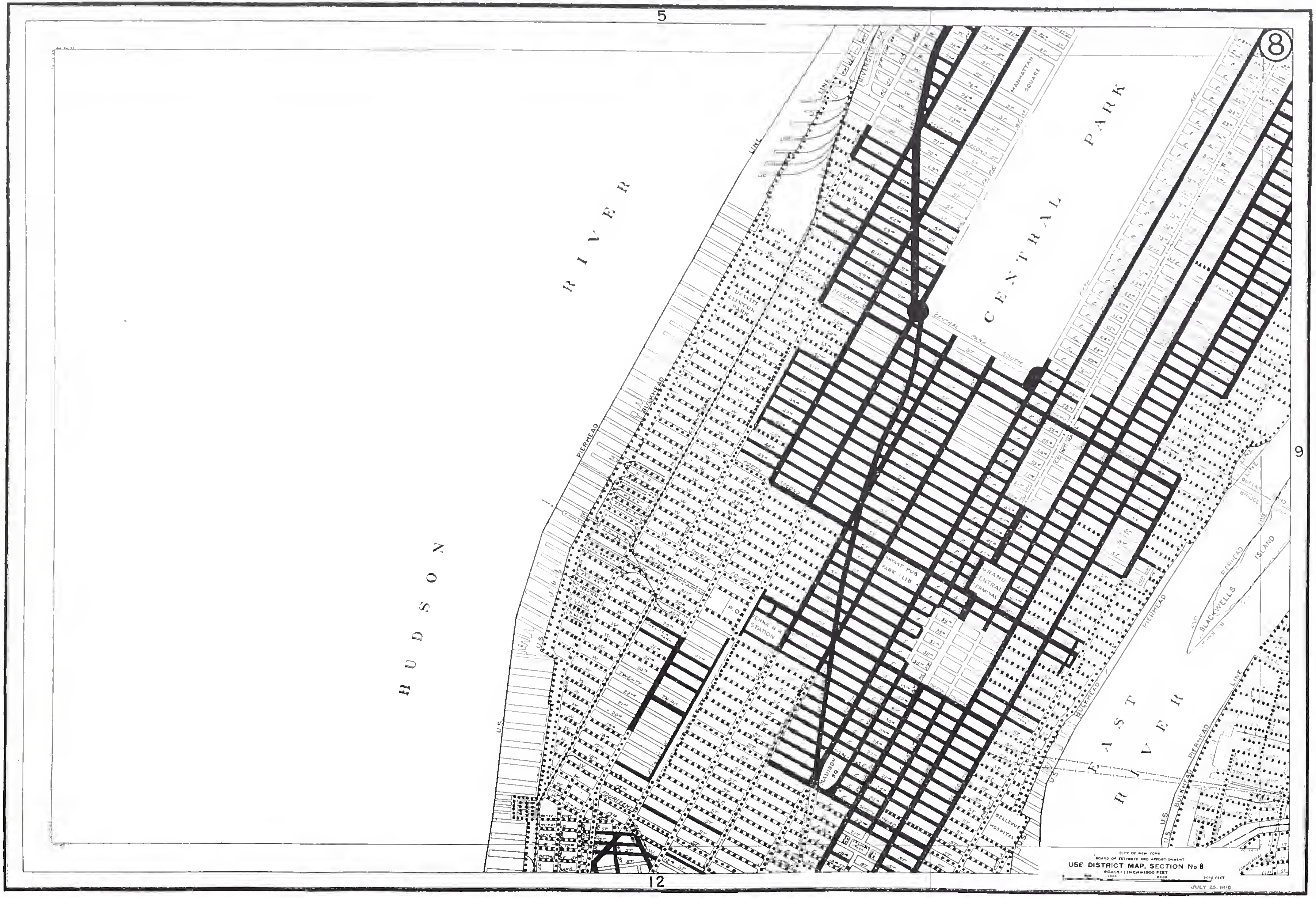
* Special Meeting, Engineers' Club, January 26, 1917.



1. USE DISTRICT SHEET

HEAVY LINES SHOW BUSINESS DISTRICTS RESTRICTED AGAINST INDUSTRY; OPEN LINES, RESIDENTIAL DISTRICTS RESTRICTED AGAINST BOTH BUSINESS AND INDUSTRY, AND DOTTED LINES INDICATE DISTRICTS UNRESTRICTED. NO UNDETERMINED DISTRICTS APPEAR UPON THIS SHEET.

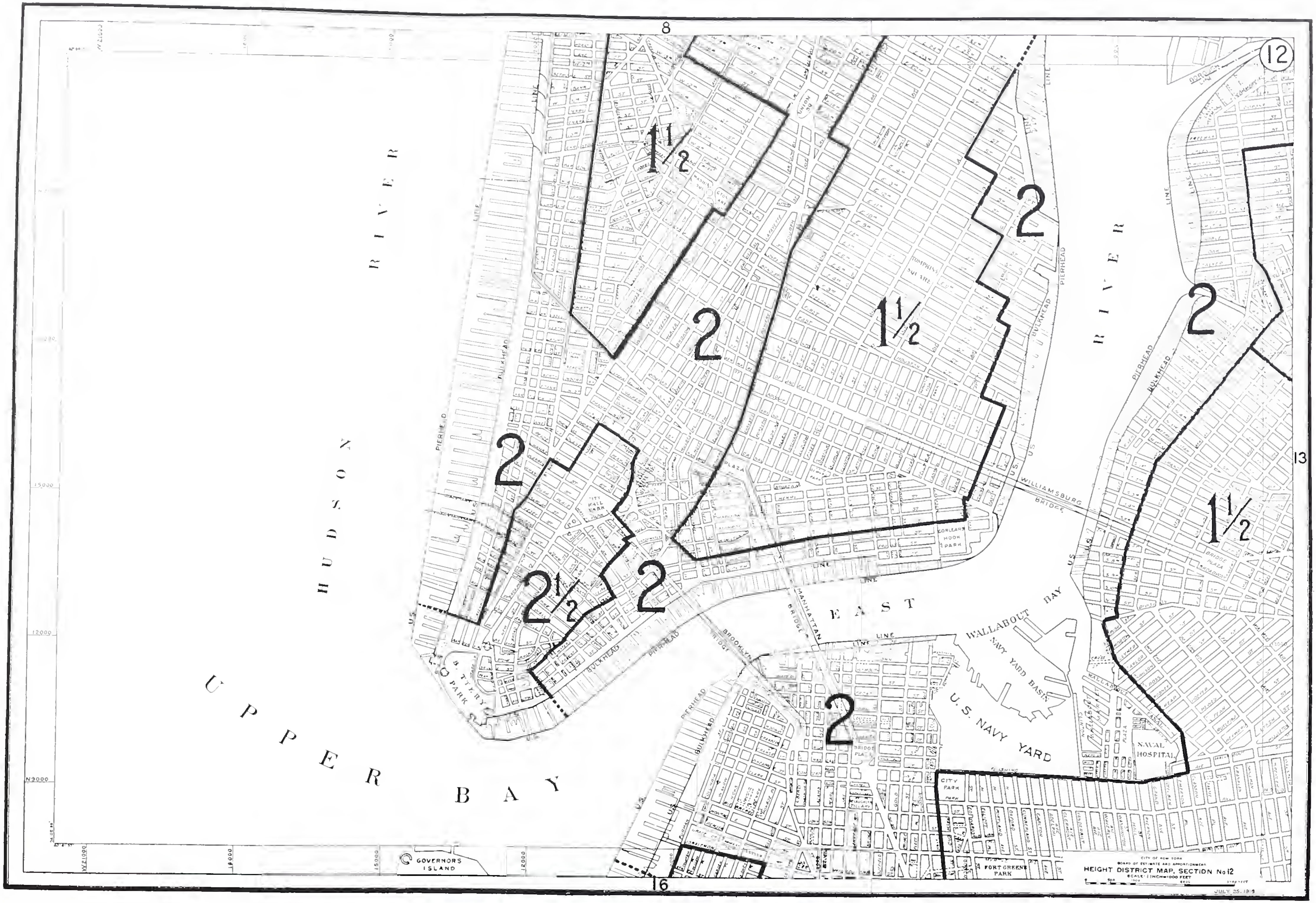
to rent that could not well be rented to any one else. Such manufacturers also appreciated a Fifth Avenue address, and they wanted their workmen and their goods close together. There was an immigration of garment makers, especially white goods makers, to Fifth Avenue and the nearby streets. Then a queer thing happened. In the mornings at seven o'clock, again at noon, and then at six o'clock in the evening, Fifth Avenue was congested with garment workers walking to and from work or strolling at lunch time, until retail shoppers found they were crowded off the sidewalks. Rents decreased rapidly, the ground floors making the best earnings, and the value of land went down, in some cases to fifty per cent. of what it had been before the advent of the garment workers. There was a problem of an invasion of the great retail street of New York City by a use rendering it less desirable for its original use, and that invasion marched up Fifth Avenue until it reached the locality of the Waldorf. When the Zoning and the "Save New York" movements came, such use was arrested, and it is hoped upper Fifth Avenue will not only be preserved, but that the lower portion, to Madison Square, will gradually be redeemed.

Private restrictions are not a remedy. Many localities, both in Manhattan and the outlying boroughs, had practiced private restrictions. Original owners of large plats placed restrictions on all or part when sold, and such restrictions, having the one source, were considered binding upon all those deriving title from that source. Sometimes restrictions were against business only; sometimes against manufacturing, or against nuisances, or the selling of liquor. In the suburbs these restrictions brought about uniform set-backs from the street line, and sometimes the building of one-family detached houses. These private restrictions helped to build up splendid localities, but there were difficulties with them. When nearing the expiration of restrictions, vacant lots, especially on corners, tended to remain vacant, awaiting such time that they could be used for a purpose such as an apartment house or store, and so exploiting a fine residence neighborhood that the private restrictions had built up. Around the edges of these restricted localities, business or apartment houses, or factories, would be worked in, and, if the restrictions were perpetual, the courts would sometimes decide that there had been a change in the character of the neighborhood and that the perpetual restrictions were considered to have lapsed. Owners of vacant land would even restrict the first portions of large lots sold until a fair scattering of fine houses was assured, and then they themselves would sell the remainder at high prices, without restrictions, permitting the newcomers to exploit their neighbors by building business places or apartment houses. Private restrictions have thus acquired a reputation of not restricting. If Greater New York, as a whole, were left under the protection of private restrictions alone, as years go by there would be no visible effect of such private restrictions upon the ultimate upbuilding of the city.

About four years ago, George McAneny, then president of the Borough of Manhattan, a nervy practical man with an imagination, proposed that something be done to bring about a harmonious method of building in New York City to prevent the continuance of these harmful invasions and the stealing of light and air by covering the entire area of a lot. The problem that immediately arose was the problem of the skyscraper, and the skyscraper was studied in an effort to prevent extreme heights and the erection of large buildings covering entire lots. The Commission appointed by the Board of Estimate took evidence on the subject for a whole year and studied the skyscraper from every angle. Statistics were gathered that were startling. Closely-packed buildings, buildings of unlimited height, were found to be injurious to the investor and to neighboring owners. Rules were formulated limiting the heights of such buildings to the street width or to some multiple of that width, and providing that such buildings might exceed the prescribed height only by a set-back from the building line. Towers were allowed because they lend interest to the buildings of any great city. It was found that making limits in the skyscraper district was but the beginning of the problem. To bring a remedy to one part of the city and to a certain sort of building would have effected only a partial cure. The favor of the courts could probably only be secured for a plan of which it could be said that every locality of substantially the same sort was treated in substantially the same manner. The Commission formulated a law, and that law was the beginning of zoning in New York City. The law was made a part of the City Charter and provided for an appointment, by the Board of Estimate, of the Commission on Zoning, to which commission were given all the police powers of the state of New York having to do with the height, size, area, and use of new buildings.

Work upon the zoning problem has been in progress for more than two years. The field was a new one of original work, as it was necessary to discover the class of buildings and to make types of buildings and then to find a method of making restrictions that would be fair and that would be suitable for an American city where the work must be done under the police powers of the state, and not by the mandate of rulers unbound by a written constitution. There was opposition; Mr. McAneny and his co-workers were styled "city beautifiers," and it was predicted that their work would have no practical chance of ultimate success and would make no headway inside of fifteen or twenty years.

Detailed maps were prepared for every borough, showing the allowable heights of buildings, the percentage of lots that could be covered by new buildings, and showing the use of new buildings. These maps were made street by street and block by block. The heights map showed the allowable heights of buildings following the prescribed



2. HEIGHTS DISTRICT SHEET

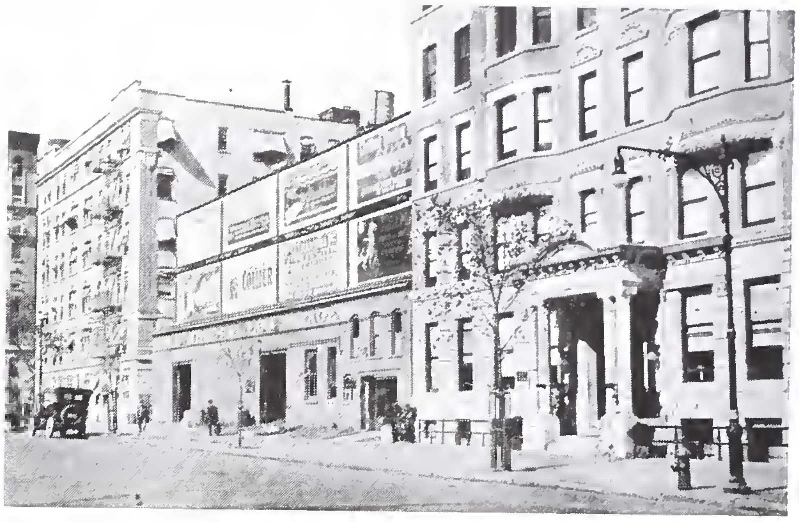
AREAS ARE MARKED OFF IN WHICH NEW BUILDINGS MAY BE ERECTED ON THE STREET LINE TO A HEIGHT NOT IN EXCESS OF 1½ TIMES, 2 TIMES OR 2½ TIMES THE STREET WIDTH. ABOVE HEIGHT LIMIT ON STREET LINE, BUILDING HEIGHT MAY BE INCREASED IN A RATIO OF SET-BACK OF THE EXTENDED PORTION FROM THE STREET LINE.

rule. These heights were adapted to the various parts of the city. The area map provides for the percentage of lots to be covered, and the use map for the establishing of industrial, business, and residence sections throughout the entire city. There are five boroughs in Greater New York—Manhattan, The Bronx, Brooklyn, Queens, and Richmond—and of each of these boroughs maps have been prepared as the result of intensive study upon the ground, so that this great city is now fixed for its ultimate development and building, from the Yonkers line on the north to Tottenville, Staten Island, near Perth Amboy, on the south, and from the Hudson River to Flushing and Rockaway Beach.

Some one may say, "How can any city be run into a fixed mould on a restriction plan and not be allowed to grow? Everything growing requires changes." That is conceded. To provide for these changes, the law was amended to the effect that the people in any district may petition the Board of Estimate to make the alterations they desire, provided a public hearing on advertisement first be held, and also that, if twenty per cent. of the frontage affected protests in writing, the change could only be made by unanimous vote of the Board of Estimate. This method is actually working out to-day quite successfully, because, while it stiffens the plan—and the plan must have rigidity—it enables needed changes brought about by the development of the city to be made. The law was approved by the Board of Estimate on July 25, 1916, and has been received with much favor and unanimity by the people of the city. No class or trade or profession opposed the law. Bankers, title companies, insurance men, owners of vacant land, owners of skyscrapers, owners of old buildings, erectors of new buildings, fire department and health department officials, physicians, and all have given their united support. This has been brought about by four years of constant education and publicity and the holding of conferences. Three hundred conferences and hearings were held throughout the city, and gradually hundreds of citizens in the different boroughs became acquainted with the details of the plan and the law, so that when the matter came up for a final hearing before the Board of Estimate almost complete unanimity resulted.

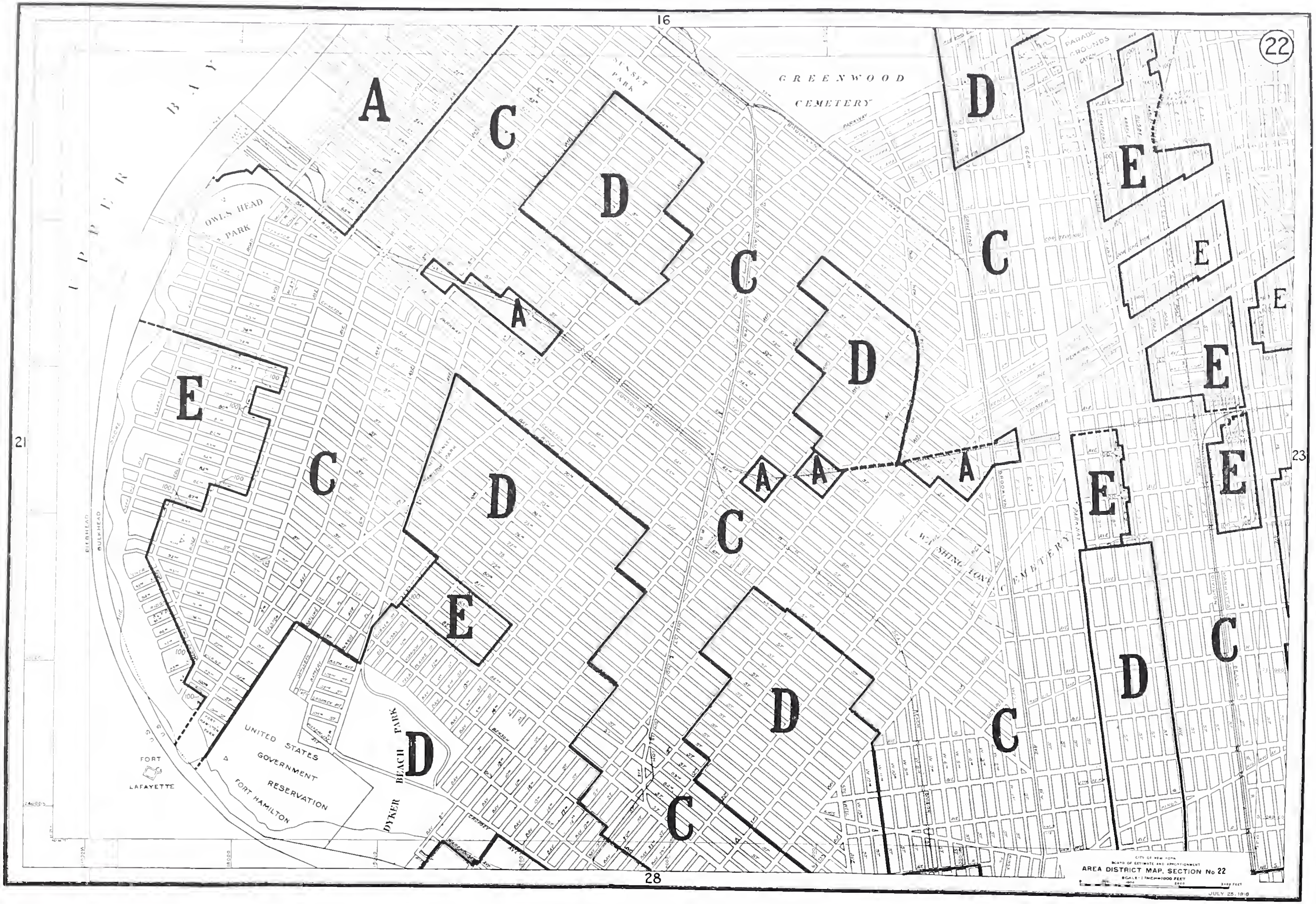
Just previous to the final adoption of the zoning law, a movement arose in Fifth Avenue called "Save New York." This movement had extensive advertisement and was an attempt to bring Fifth Avenue back to its former high-class use. The merchants contributed to stop further harm to the avenue, and directed their efforts to transplant the garment factories occupying the lofts of high building to localities further south in the city. The movement has been very successful, and many factories have either moved away entirely or have made preparations so to do. Property on Fifth Avenue is now taking on new life and value which it has not enjoyed before, and, since the passage of the zoning law, the stabilizing influence of that law has been felt throughout all of Manhattan. In the suburbs, residents do not avoid the expense of making additions or alterations, as they feel that the law now protects them indefinitely. There are renewed hopefulness and increase of values throughout the entire city. Business districts are protected against industry, and resident districts are protected against both industry and business. The factory and the public garage are no more the terrors they were five years ago.

When work was begun upon the zoning law, public garages did not seem to be harmful, but it was found, on investigation, that they were becoming one of the greatest detriments to property values in New York City, and they were finally prohibited in the residence and business districts and allowed in the industrial districts. This action alone seems to have justified all that has been done, because business places of high class and residences are saved from the blight of public garages next door.


ILLUSTRATING PUBLIC GARAGE INVASION OF HIGH-CLASS APARTMENT HOUSE SECTION

All of the zoning work is done under the police powers of the state. The courts have been careful never to define police powers. They permit them to increase in their scope as the needs of humanity increase, as they are based on safety, health, morals, and the general public convenience. The maintenance of the zoning system in New York City rests now with the courts. Careful preparation, however, has been made, not only by the city, but by associations of private individuals, to see that the needs of the city, from a health, safety, and general public convenience point of view, will be fully placed before the courts.

As a great city grows and as new needs come, there must be a recognition of increased police power over and above what would be recognized as necessary when such a city was comparatively small. It is hoped that zoning work done along the line of the present needs of a modern city, where what is done is for the benefit of all and as a community act, will be considered a necessary and proper exercise of police powers.



3. AREA DISTRICT SHEET

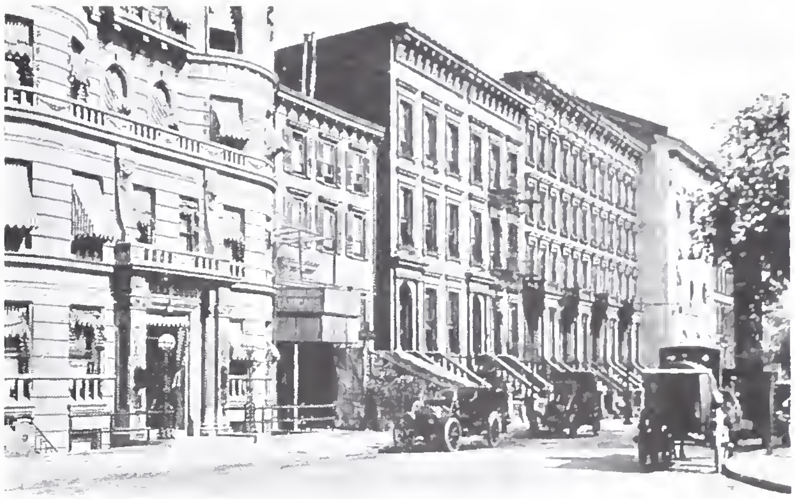
IN **A** DISTRICT ENTIRE LOT FOR NON-RESIDENTIAL BUILDINGS MAY BE BUILT UPON. **B** AND **C** DISTRICTS PUT GREATER RESTRICTIONS ON AREAS OF LOT OCCUPIED. **D** DISTRICTS ARE INTENDED TO PRESERVE RESIDENTIAL SECTIONS FOR ONE- AND TWO-FAMILY DWELLINGS AND REQUIRE DOUBLE THE OPEN AREAS ALLOWED IN **B** DISTRICTS. THE **E** DISTRICTS ARE PRIMARILY FOR DETACHED AND SEMI-DETACHED HOUSES IN WHICH AT CURB LEVEL FIFTY PER CENT. OF LOT AREA ONLY MAY BE OCCUPIED. IN EACH AREA DISTRICT YARDS AND COURTS ARE DIMENSIONED PROPORTIONAL TO BUILDING HEIGHTS.

(Mr. Ford's paper was principally explanatory of slides exhibited, showing actual conditions in congestion of traffic in New York City, the breaking down of residential districts by other uses, the invasion into residential districts by business, the wiping out of set-backs in other portions of single blocks, and observations upon a series of maps forming part of the New York zoning law.)

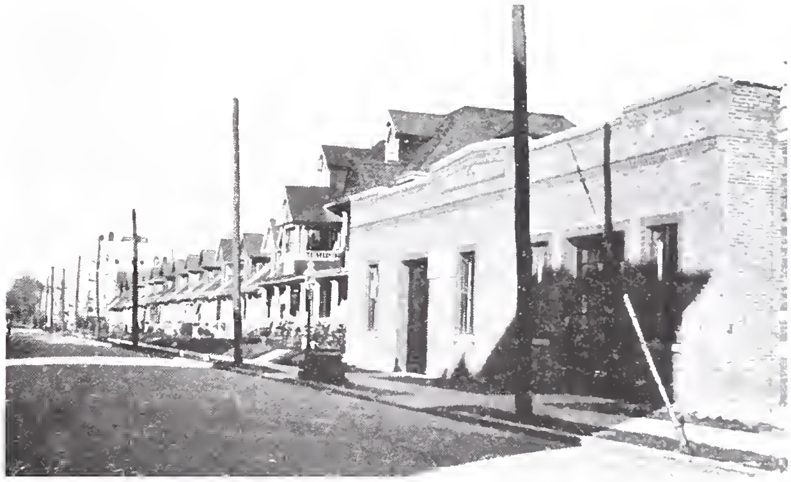
IN dealing with the problem of zoning in New York City, we felt our first duty was to know the city intimately and in detail. Patience and persistence in this idea enabled us to prepare the complete use, height, and area maps which form part of the zoning law as now in force in the city.

The first step was mapping the city in detail, showing the use of buildings for residences, business, industrial, manufacturing and railroad purposes. Such maps were made for each block in the city. Again, the same detail was shown for the heights of the various buildings throughout the entire city, and also another set of maps showed the portions of the lot occupied. In addition to these maps, a complete topographical map was made, showing by contour lines the various levels, and the park land; also the gradients of the different streets, so that we might know what streets were adapted for heavy traffic and therefore principally usable only for commercial purposes. Another map showed the time zones of the new rapid transit system, calculated from the City Hall as a center to all parts of Greater New York. Areas within ten, twenty, thirty, and more minutes were separately shown. Such maps indicated the comparative accessibility of each point in the city to the City Hall, and a large part of the districting, with regard to the intensity of the occupation of land, was based on this map. Still another map showed the use of streets for trucking or for automobile traffic, and indicated the relative density of traffic upon different streets. Such a map would show the relative importance of travel from a traffic point of view, and might indicate where business would be located to follow such lines of travel. A base map of the street system was also prepared, upon which the final plans were developed. Another map indicated the boat and railway terminal facilities throughout the city. From such a map the manufacturing, industry, and warehouse districts could be located to place them in close communication with transportation facilities. A map also showed the streets already physically opened and where opening proceedings were under way, so that streets already available for use were indicated, and also those not at present available but for which plans could be made for opening in the future. Another map showed the entire metropolitan district of New York, including Staten Island, which comprises an area of 327 square miles, and for that area 111 separate district maps are now available for use, height, and area limitations for every street and every block.

GEORGE B. FORD
CONSULTING ENGINEER
NEW YORK CITY


ORIGINALLY PRIVATE RESIDENTIAL SECTION; TRANSFORMATION TO APARTMENTS; AND INVADED BY GARAGE—OPPOSITE A PUBLIC PARK

Tentative district maps were first prepared, and the final regulations for districting were formulated by a policy of elimination. These tentative maps were published in March, 1916, and were spread broadcast throughout the city. The newspapers explained them in great detail. As a result of this campaign of education, a strong public opinion was built up in regard to the system which actually insisted that the regulations laid down by the Commission upon these tentative maps should be made more drastic. The final maps were adopted by the Board of Estimate and Apportionment on July 25, 1916. In some of the area districts, notably in Brooklyn, property owners in large numbers petitioned the Board to increase the areas of the E zones, the district of


SHOWING INVASION OF RESIDENTIAL DISTRICT AND AVOIDANCE OF SET-BACK

minimum occupancy, so that in some cases such districts covered five times the original area mapped. In Flatbush, in the use map, the people demanded that a great many business streets be changed to residential streets, despite the fact that by so doing walking distance to the business streets would be considerably increased, in many cases making a walk of a mile to the nearest store. In the heights district maps there are several hundred buildings existing to-day that are higher than the new limitations permit. In the lower part of Manhattan there are nearly a hundred of such buildings. A new building built to-day on the site of the Equitable Building, which is 36 stories high, could only be built to a height of 16 stories. Such limitations upon the height of this character of building were based on the testimony of property owners and real estate men that such tall buildings rarely pay.

Since the zoning law became effective on July 25, 1916, many demands for changes were anticipated, but the number of such demands have been astonishingly small, and the larger portion of the petitioners asked that certain restrictions be made more drastic. As the law stands to-day it seems well able to defend itself.

SHOWING CONGESTION ON BROADWAY, NEW YORK, NORTH FROM TRINITY CHURCH, AT NOON HOUR

WE have listened with great pleasure to the gentlemen who have come from New York to enlighten us. They speak from experience; we can only speak in anticipation. The complexity of the problem confronting any set of men undertaking to bring out of chaos such order as has been done in New York seems at first staggering. I endorse what both Mr. Bassett and Mr. Ford have said regarding New York conditions. A suit that would fit New York might not fit Philadelphia or Washington. The conditions of life, of business, of industry, and the social conditions vary so much in different cities that each city must be studied entirely from the standpoint of its own characteristics. We resemble the original New York Commission in that we are also fearful of our steps and hesitate to make any radical expressions of opinion. One member of the Commission stated that he had to take the entire Commisson on board a boat so as to be where the members could not get away from him, and for a whole day argue with the individual members to impress them with the importance of the undertaking on which they had embarked. He said he succeeded only because he had them corralled on shipboard.

GEORGE E. DATESMAN
DIRECTOR, DEPARTMENT PUBLIC WORKS, PHILADELPHIA

Every time I have heard about the work of the New York Zoning Commission it has been for my instruction, and what impresses me most, as a member of the Philadelphia Commission, is the magnitude of the problem we have before us. The popular view would be that when we begin to interfere with so-called individual rights we at once invite opposition. We have an idea of liberty on this American continent, and especially in the United States, that is very different from the idea of liberty in a monarchical form of government. Municipal matters are controlled by government abroad; in this country we feel that each individual is a government unto himself. When a man here buys real estate he feels it is his right as a citizen to do with it as he pleases. The examples that have been shown us of the awakening of individuals and whole communities to the view that the individual must be lost in the community interest in order that he may protect himself are proved by the New York law, and with proper publicity in Philadelphia we will find that individual independent planning will be superseded by planning in the community interest.

If individual property owners, operative builders, and real estate men could know the effect upon their holdings of a multiplication of similar buildings about them and the consequent depreciation of values and earning power, they would come to believe that a 40-feet-wide street should not be used for a 15- or 20-story building.

One of the principal things that has been forced upon us in Philadelphia is the encroachment of the public garage and various kinds of business upon residence districts. Such invasions have become nuisances and have acted as a detriment to real estate and rendered values insecure in such neighborhoods. Our operative builders are beginning to appreciate the importance of building regulations, for the Commission is in almost daily receipt of applications for relief.

Philadelphia is a peculiar city, spread out in many directions and with heterogeneous buildings scattered over the entire area. The peculiar topography of the city, also, cut up as it is by railroads in all directions, raises many economic municipal problems. If restricted areas can be established for industries, the railroad lines and main heavy traffic avenues could be concentrated so as to make for economy in public expenditures.

The regulation of the height of buildings is not so important here as in New York, use being of first importance and the area of lot built upon being for second consideration. The Philadelphia Commission, organized but recently, has already done considerable preliminary work, and we have been encouraged by the statements made by Mr. Bassett and Mr. Ford as to the practical work accomplished in New York and the encouragement that has been given to the project by the public. If the public here will support this project, worked out for its own interest, rather than place obstacles in the way of its accomplishment, the result should be a successful building up of a greater and better city.

IT is always a comfort to hear men from New York City tell us of something in that city really worth copying, because for years New York has been the great example of what not to do. New York's "Model Tenements" are vastly inferior to Philadelphia's two-story, single-family houses, and yet one Philadelphia philanthropist was so impressed by New York's tenements that he actually built such a tenement here to show us what to do. Not long ago Mr. Lawrence Veiller said: "New York's Model Tenements are merely purgatory, as compared with the hell they used to have; they are nothing like the heaven you have in your Philadelphia two-story, one-family houses," of which we have 225,000.

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ANDREW WRIGHT CRAWFORD
SECRETARY, ART JURY
PHILADELPHIA

In this matter of zoning, New Yorkers showed the way of approaching the subject. They did not, however, establish the first precedents, for Los Angeles and Boston have that honor. Boston led off by districting itself into two height-limit districts. One hundred and twenty-five feet was fixed in the central district, and 80 feet everywhere outside of that district, and that zoning regulation was upheld by the Supreme Court of Massachusetts and the Supreme Court of the United States. Los Angeles determined upon a residence district, but the owner of a big clay deposit in that district proposed to make bricks from the clay on his own property. He claimed he had a vested right to do that, but the people of Los Angeles thought differently. The Police Commissioner was about to enforce the regulation, whereupon the clay owner brought an action to restrain the city from enforcing that regulation. The Supreme Court of the United States upheld the decision of the Supreme Court of California that a city has the right to protect the interests of the city and its citizens even against a vested interest, so that this power of districting is one that can be exercised under the Constitution of the United States. It is, however, a power that must be exercised reasonably; such regulations cannot be unreasonable.

In the E zones of New York it is proposed to have 70 per cent. of each lot free from buildings, and that is a big advance over what obtains in Philadelphia. Where the ordinary two-story, single-family house is built on a minimum lot 14 feet front by about 41 feet in depth, a flat rule requires 144 square feet of the lot to be unoccupied. This regulation holds irrespective of the frontage or the depth, and for the minimum-sized lot it figures 25 per cent. of the lot left unoccupied. This means that outside the street lines the ordinary two-story house in Philadelphia—the workman's house—is built 45 houses to the acre. If we adopt the E zone principle of but 30 per cent. of lot to be built on, 45 houses to the acre will be reduced to 20 houses per acre. It is magnificent that New York City had the courage to put such a regulation into force. It is hoped we may even do better for the outlying sections of Philadelphia. I do not see why, ultimately, what has been done in England for 18,000,000 working men and their families under the Housing and Town Planning Act of 1909 should not be accomplished here. Under that act, garden cities and garden suburbs to the number of about 58 have actually been built, and in those cities and suburbs the average is 12 houses to the acre. The city of Minneapolis has done somewhat better even than that, for in the residential section, except in the center of the city, houses have been built only six to the acre. Under the new regulations to be put in force in Philadelphia, we may do even better than New York has done by keeping houses for the workmen to, say, 12 to the acre, considering there are so many more workmen than capitalists and the capitalists can look out better for themselves. If we do not improve upon the New York law, we shall have lost a great opportunity.

With regard to developed sections, there are many peculiar situations. At a particular location in Philadelphia, on one corner stands a branch public library; on another corner, a five-story apartment house; on the third corner, a private residence, and just beyond the open lot on the remaining corner is a very artistic church building. It is stated that it is now proposed to build an oil or gasoline structure on the fourth corner, and the attorneys for the oil company state that the structure will be unobjectionable, because it will be "artistic." If that structure were an oil tank values in that neighborhood would depreciate at once and the city would also lose in tax revenue. When values go down, assessments for taxation go down with them. The city's income goes down, and the borrowing capacity is likewise reduced; so that, in this matter, the city's income for current purposes and its borrowing power for permanent improvements are both involved, as well as the values of private interests. With regard to areas already occupied in the built-up sections of the city, we cannot do much; but, as in New York, in regard to all three subdivisions, height, use, and area built upon, individual studies must be undertaken and individual blocks investigated completely and carefully, one by one.

With regard to occupancy, the central portions of the city should not be used for heavy manufacturing purposes. Residential districts should be created in order to prevent various things that are not regarded as nuisances at common law. With regard to height, I agree generally with Director Datesman, but am not quite sure that the question of height limitation is less important than the question of use. Use is not as important as the area of lot to be left open, because the latter is so intimately related to the public health that any Supreme Court Justice could not fail to say that this directly concerns the police power. In England, figures show that life in the garden suburbs is vastly more healthy than in cities. In Philadelphia the death-rate is 15 per thousand; in English garden suburbs and cities it is about 5 or 6 per thousand, and I have similar statistics available as to the effects on the height and weight of growing children. It seems to me, therefore, the matter of the portion of the lot to be left open is the most important thing to be taken up.

Next in importance is the question of the limitation of the heights of buildings in the central area. We are absolutely up against that proposition to-day. The Chestnut Street "canyon" is becoming darker with the erection of each new building, and it is time for us to take vigorous steps to prevent more darkness, more dampness, and more unhealthy conditions. There is a considerable area around City Hall, between it and neighboring buildings, and in that locality the standard already set by the Wanamaker and Widener buildings may be accepted, and therefore it may be tentatively suggested that the height limitations for the area, say from the west side of Thirteenth Street to the south side of Arch Street, and from the east side of Fifteenth Street to the north side of Chestnut Street, may follow the Wanamaker and Widener standards. Elsewhere, the maximum should be the Boston and Scranton maximum, which is 125 feet.

The central business area will be limited to some extent by the loop proposed for the transit system. I do not think the effect of that loop will be good. Chicagoans say that the transit loop has frightfully throttled the development of the city. In the central loop there is no question we will find the great business area of the city. There may also be a traffic circuit bounded by Locust Street, Seventh or Eighth Street, Race Street east of Broad Street, Arch Street west of Broad Street and perhaps Sixteenth Street. The business area will undoubtedly extend as far as the Delaware River, so that the central business area of Philadelphia in the near future will be defined by Seventeenth Street, the Delaware River, and Spruce and Vine Streets, and there will be a tendency to push that area west to the Schuylkill River. This can be controlled to some extent. In that area some multiple of the street width should be adopted for the building height. If Chestnut Street be taken as 60 feet wide, buildings should be permitted to twice that height, or 120 feet, which will include a building of about 11 stories. On certain wider streets, greater heights may be permitted, but in general a maximum height of 125 feet should be determined upon. Individual blocks should be studied for individual lower maximum heights.

Outside of the central area, the maximum height should be fixed at 80 feet, as in Boston. The advantage of that limitation is that it has already been upheld by the Supreme Court of the United States. In many sections of Philadelphia we might safely adopt the standards of English, German, and French cities for a height limitation varying from 60 to 75 feet.

We have a great opportunity here in Philadelphia, and the problem must be carefully studied. What is done will affect the city, its growth and the health of its inhabitants vitally for generations to come, and therefore we must have courage and not fear to pioneer even in legislation.

FIRST REGIMENT
PENNSYLVANIA INFANTRY
NATIONAL GUARD
UNITED STATES

A Short History and Photographic Record of the
FIRST REGIMENT
PENNSYLVANIA INFANTRY
NATIONAL GUARD UNITED STATES

Colonel Millard D. Brown
Commanding

History of First Regiment Infantry of Pennsylvania

ON April 19, 1822, the Light Artillery Corps of Washington Greys was formed in Philadelphia, and was an active military organization until the Civil War. Then in response to the call of President Lincoln of April 15, 1861, it formed Companies A and F of the 17th Pennsylvania Infantry, and on the 25th day of April moved with other troops to Baltimore, Md.

Concurrently with the President's proclamation, the need for further organization being so apparent as to require immediate action, of their own motion, a number of members of the Artillery Corps—still on the rolls, but no longer active—caused to be inserted in the public prints a notice requesting the retired and contributing members, over the age of 45 years, to meet on the evening of the 17th of April, 1861, "*For the purpose of organizing a Reserve Guard for the protection of the City and support of the Constitution and Laws of the United States of America.*"

The response was so unexpected, the attendance so large and applications for membership so numerous that the original intention to form but a single company was abandoned, a regimental organization determined upon, the age limit removed, all able-bodied citizens, disposed to be helpful in the crisis, invited, and the meeting adjourned from its wholly inadequate quarters to the Wetherill House on Sansom Street above Sixth, to assemble again at Sansom Hall, more suitable for a large gathering, two days later.

On the evening of the 19th of April, at this adjourned meeting, Colonel Charles Somers Smith presided and Colonel P. C. Ellmaker acted as Secretary, and there were in attendance many men of unusual civic prominence.

A "Plan of Organization" was agreed upon, uniform adopted, field, staff and company officers selected, and Eight Hundred and Twenty-five men were ready for enrolment.

At that meeting Peter C. Ellmaker was named Colonel, Richard H. Rush, Lieutenant Colonel; Napoleon B. Kneass, Major, and Charles Somers Smith (later Colonel), Captain of "A" Company. The organization was to be known as "The First Regiment Grey Reserves of the City of Philadelphia;" its uniform was to be, in color, a cadet grey and in pattern of the service dress of the United States Infantry. A significant feature of the "plan" was that "until the Regiment shall be recognized by the constituted authorities, the officers shall be invested with the same power and authority as though they were duly commissioned by the Governor of the Commonwealth."

The Regiment bore this designation until, by the First Section of the Act of Assembly of April 7, 1870, which created new methods for the organization, discipline and "regulation of the militia," it was provided that thereafter the active militia of the Commonwealth should be known as the "*National Guard of Pennsylvania*." From then on the Regiment has been known by the far more euphonious title of "*First Regiment Infantry National Guard of Pennsylvania*."

Out of this organization, besides the 17th Pennsylvania, were formed the following regiments with Civil War service:

1861—Grey Reserves, Reserve Brigade, 119th Pennsylvania Volunteers; 3d Brigade, 1st Division 6th Corps, Army of Potomac.
Colonel PETER C. ELLMAKER. 1861 to 1865.

1861—118th Pennsylvania Volunteers (Corn Exchange Regiment). 1861 to 1865.

1862—7th Regiment Infantry Pennsylvania Militia, Antietam Campaign.
Colonel NAPOLEON B. KNEASS.

1863—32d Pennsylvania Militia, Gettysburg Campaign.
Colonel CHARLES SOMERS SMITH.

The First Pennsylvania Infantry as in service today is the direct descendant of the Grey Reserves (119th Pennsylvania Volunteers), and Company G is the representative of the organization of the Artillery Corps, Washington Greys, and Company H, of the old Corn Exchange Regiment.

Since the Civil War this Regiment has assisted in restoring order in the following riots and disturbances in Pennsylvania:

1874—Susquehanna County,
Colonel R. DALE BENSON.

1875—Luzerne County,
Colonel R. DALE BENSON.

1877—Pittsburgh Round House,
Colonel R. DALE BENSON.

1892—Homestead Riots,
Colonel WENDELL P. BOWMAN.

1902—Luzerne County,
Colonel WENDELL P. BOWMAN.

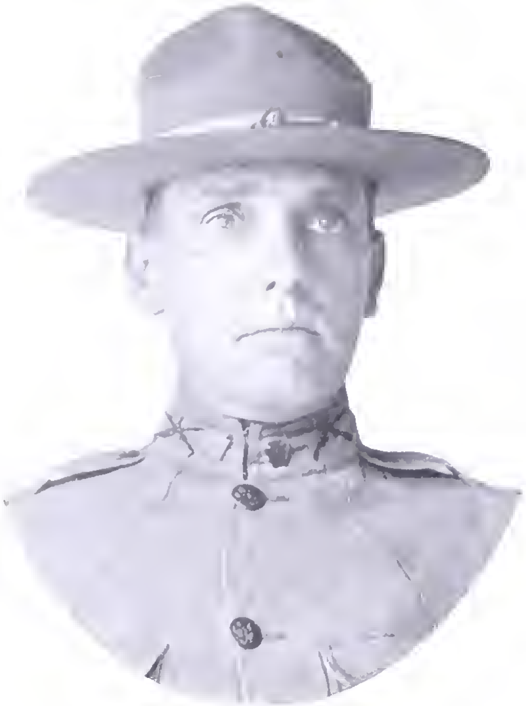
On April 25, 1898, the very day that war was officially declared between the United States of America and the Kingdom of Spain, the entire National Guard of the State was mobilized at Mt. Gretna, Lebanon County, Pa. "The Gallant

First," with its motto, "Paratus," ever before it, was true to its name and tradition. The qualification of a soldier in the National Guard of Pennsylvania, under the laws, as it existed at that time, and his oath as such, did not require or obligate him to enter the United States service in time of international war. Every officer and man in the regiment, therefore, was given the opportunity to say whether or not he would volunteer in the service of the United States for the term of two years unless sooner discharged. Colonel Bowman, whose inspiration had set the whole Regiment aglow with patriotic impulse, had canvassed the Regiment and knew by the next morning that practically 95 per cent of his command would volunteer. In response, before the hour designated by the Governor of Pennsylvania, Colonel Bowman rode over from his quarters and reported that the First Infantry, almost to a man, would respond to the President's call for volunteers. Galloping off to rejoin his Regiment, a serious and painful injury (caused by a vicious bucking horse) necessitated his removal to his home to save his life. This accident not only deprived the First Regiment of Colonel Bowman's services, but changed entirely the part the Regiment would have otherwise taken, as the command devolved upon Lieutenant Colonel Good, then a Junior Officer. The grand old Regiment promptly steadied from the shock and in less than two weeks the "First Regiment Infantry, Pennsylvania Volunteers," was mustered into the service of the United States. During its six months' tour of duty, the Regiment was not without its share of the difficulties and privations of war, for although it was not within the sound of the cannon's battle-roar, nevertheless it suffered from sickness and death, from exposure and disease.

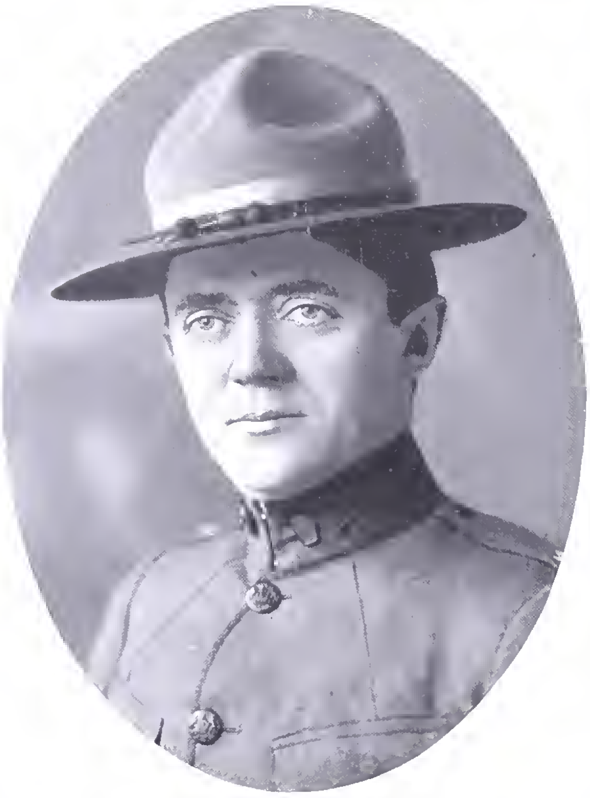
In response to the call of President Wilson, June 22, 1916, the First Pennsylvania Infantry was mustered into the United States service June 30, 1916. Entraining the same day, it was the first Pennsylvania Infantry organization to reach the Mexican border. Under the command of Colonel Charles C. Allen the Regiment made a wonderful record for efficiency in this service. It returned to Philadelphia in October and was mustered out October 23d, 1916.

On March 25, 1917, President Wilson again issued a call for troops and the First Pennsylvania Infantry was among the selected troops called out at that time. Mustered into the service again March 30, 1917, it guarded important railroad bridges and arsenals until relieved in August. It proceeded with the rest of the National Guard of Pennsylvania to Camp Hancock, Augusta, Georgia, and there was selected as one of the four infantry regiments to remain intact. At present it forms part of the 55th Infantry Brigade, 28th Division, and is officially known as the 109th Infantry.

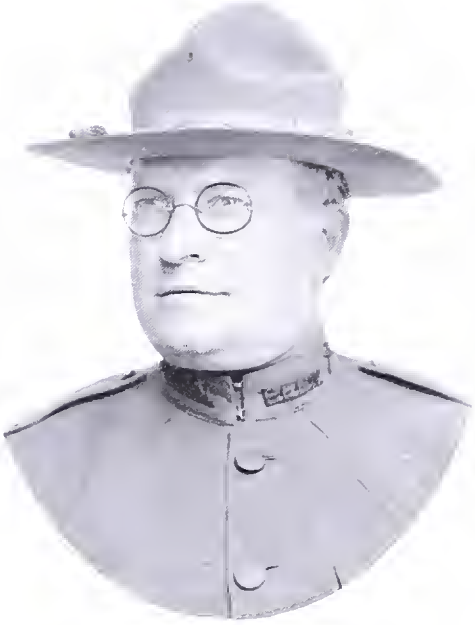
Colonel Millard D. Brown
Commanding



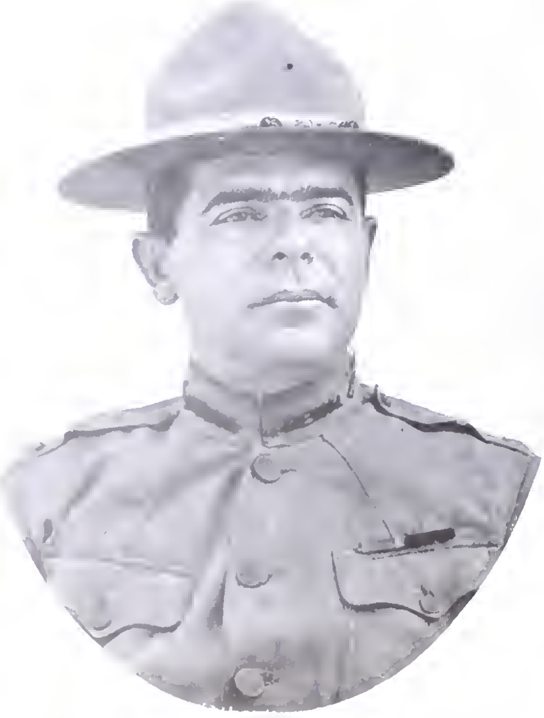
Lieut. Col. Arthur S. Fitzinger



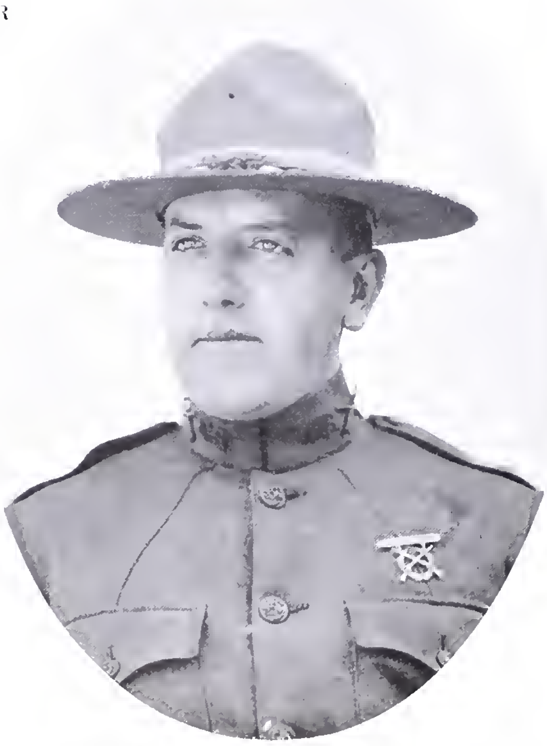
Major Thomas F. Meehan
Commanding First Battalion



Captain Clifford P. Futcher
Chaplain



Major Edwin E. Hollenback
Commanding Third Battalion



Major David B. Simpson
Commanding Second Battalion

Captain Charles A. Blumhard

Captain George Wanger

Captain William L. Rountree

Captain Walter M. Gearty

Captain Robert B. Atwood

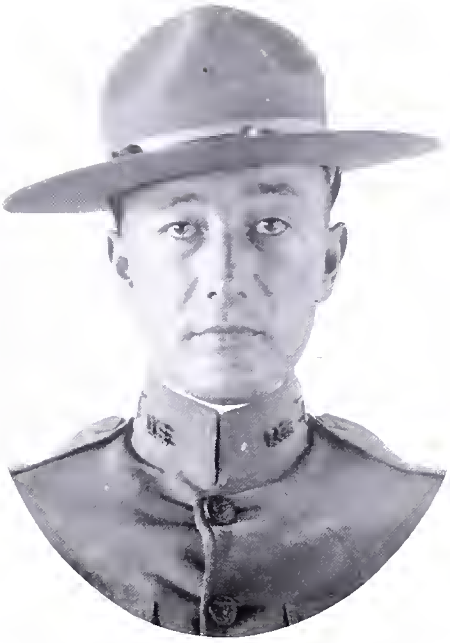
Captain George M. Orf

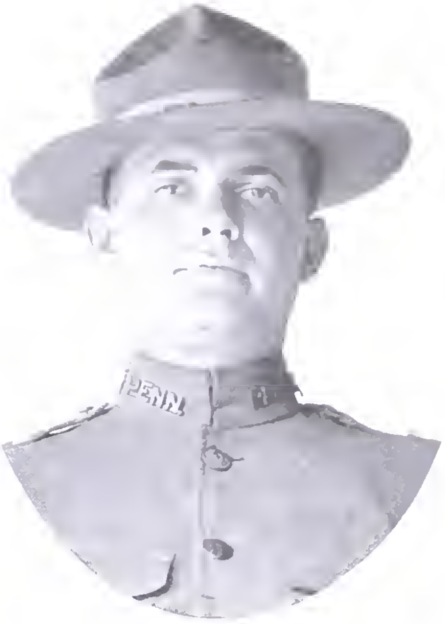
Captain John M. Gentner

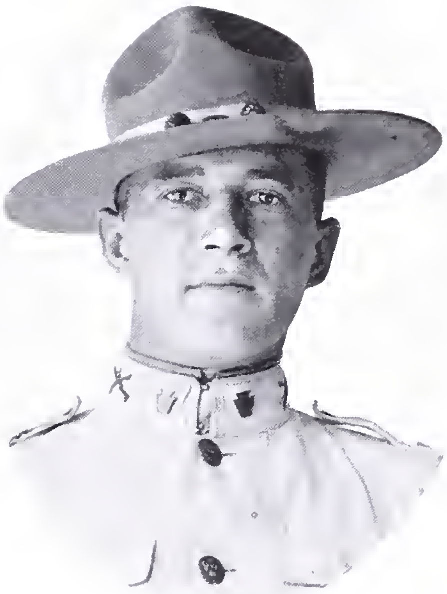
Captain William C. Williams

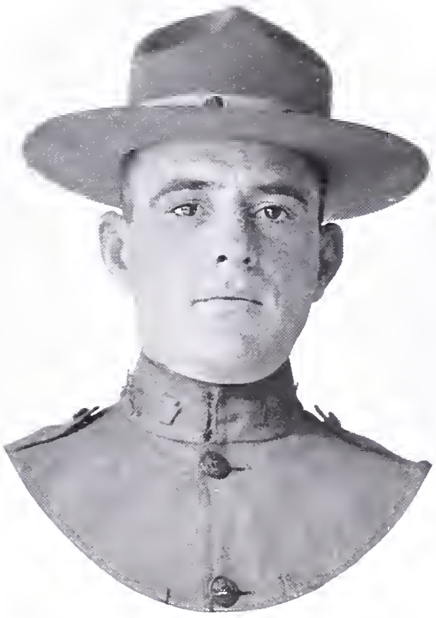
Captain Edward J. Meehan
Supply Officer

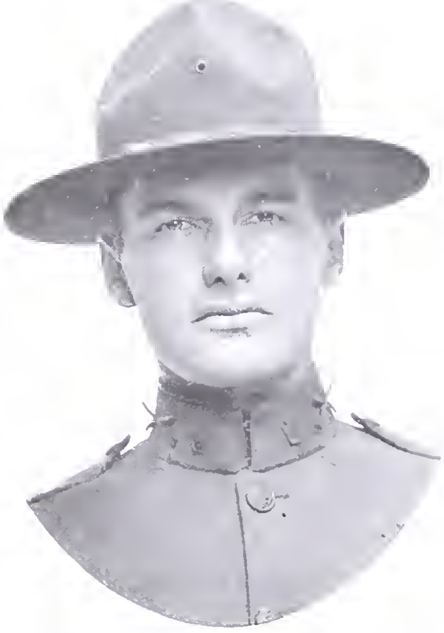
Captain Roland C. Heisler
Adjutant


Captain Harry B. Williamson


Captain James B. Cousart


Captain Felix R. Campuzano


Captain Charles F. Risler


Captain Frank R. Buggy

First Lieutenant Herbert P. Hunt

First Lieutenant Harry R. Sage

First Lieutenant Robert H. Bolling

First Lieutenant Rupert P. Pyle

First Lieutenant Clarence T. Gilmore

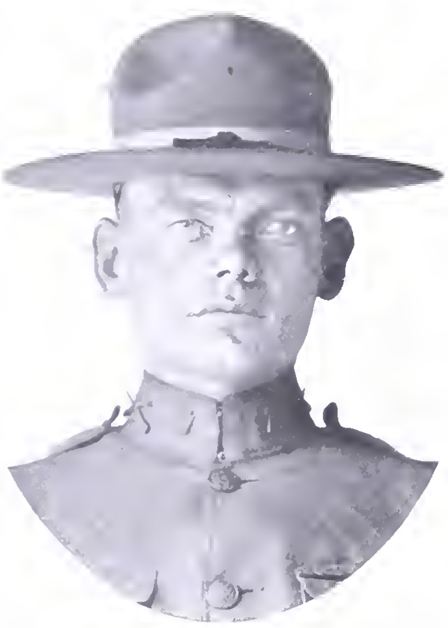
First Lieutenant Jacob M. Shinkel

First Lieutenant William A. Ruppel

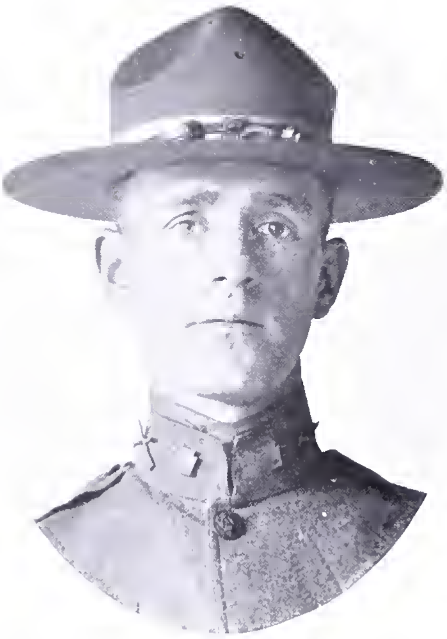
First Lieutenant Horace J. Inman

First Lieutenant Howard M. Cantrell

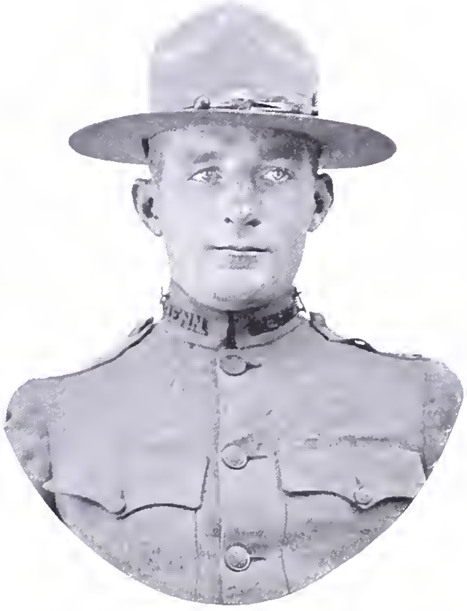
First Lieutenant Frank W. Pennapacker



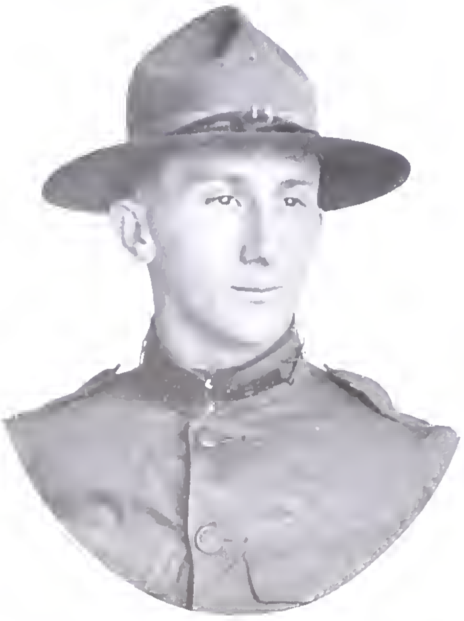
First Lieutenant Godfrey P. Keebler



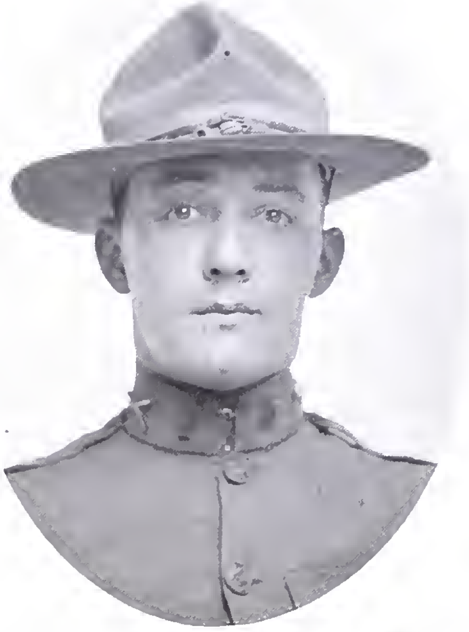
First Lieut. Rutherford McA. Warren



First Lieutenant John F. Davis



First Lieutenant Herman Sloan



First Lieutenant Harry R. Simmons

Second Lieutenant John H. Litschert

Second Lieutenant Ralph G. Spiegle

Second Lieutenant Howard G. Taylor

Second Lieutenant Richard L. Hubbell

Second Lieutenant William Lawson

Second Lieutenant Earl H. Davis

Second Lieutenant Stephen J. Ketran

Second Lieutenant Charles R. Crowel

Second Lieutenant Edward W. Sterling

Second Lieutenant Harry A. Fryckberg

Second Lieutenant Horace J. Noble

Second Lieutenant John J. Owens

Second Lieutenant James B. Schoch

Second Lieutenant Harlan Bucher

Second Lieutenant Walter Fiechter

Officers Medical Corps, 1st Pennsylvania Infantry

Major Leonard D. Frescoln
Surgeon

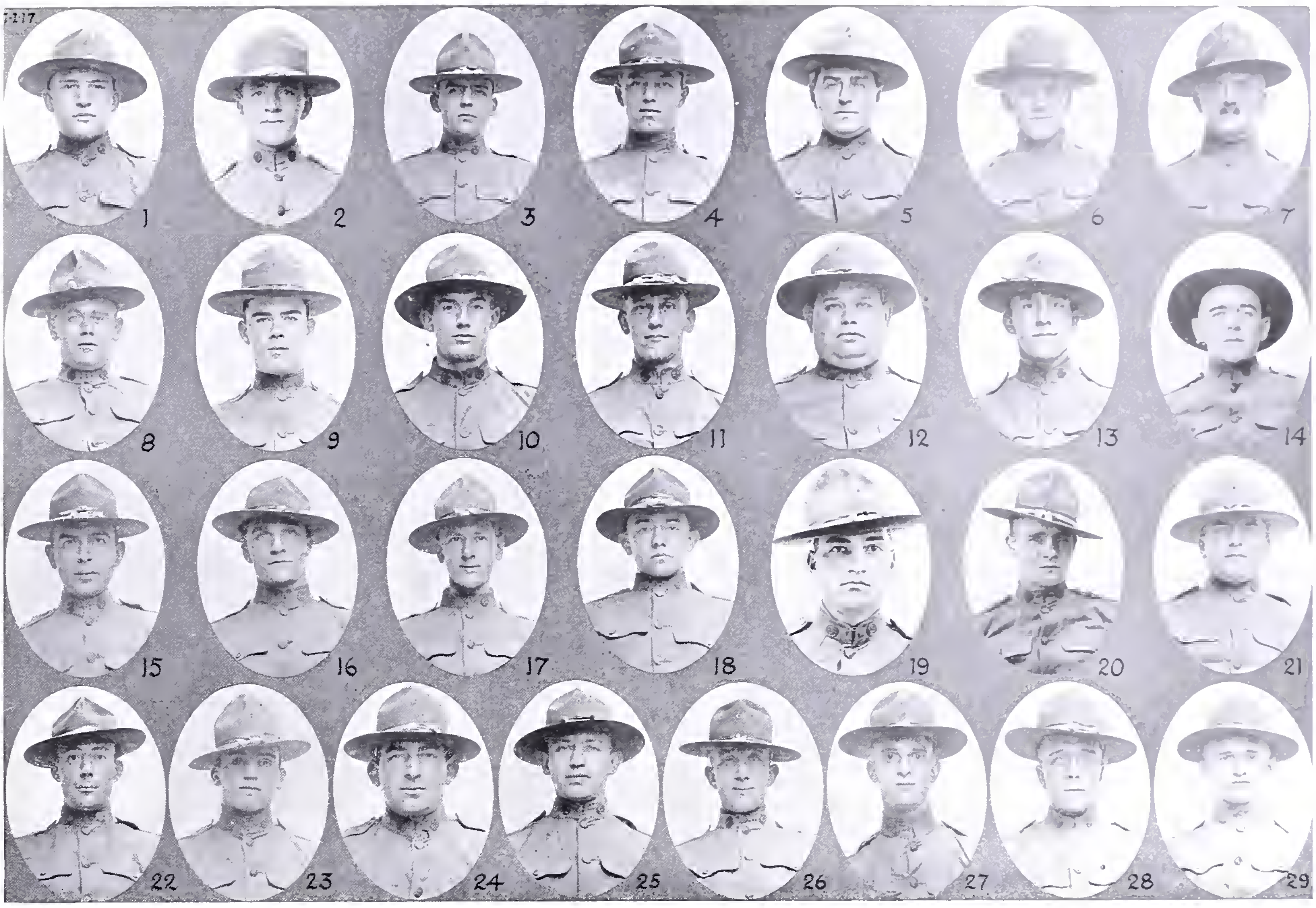
First Lieutenant Charles G. Steinmetz
Assistant Surgeon

First Lieutenant James R. Martin
Assistant Surgeon

First Lieutenant Charles S. McGivern
Assistant Surgeon

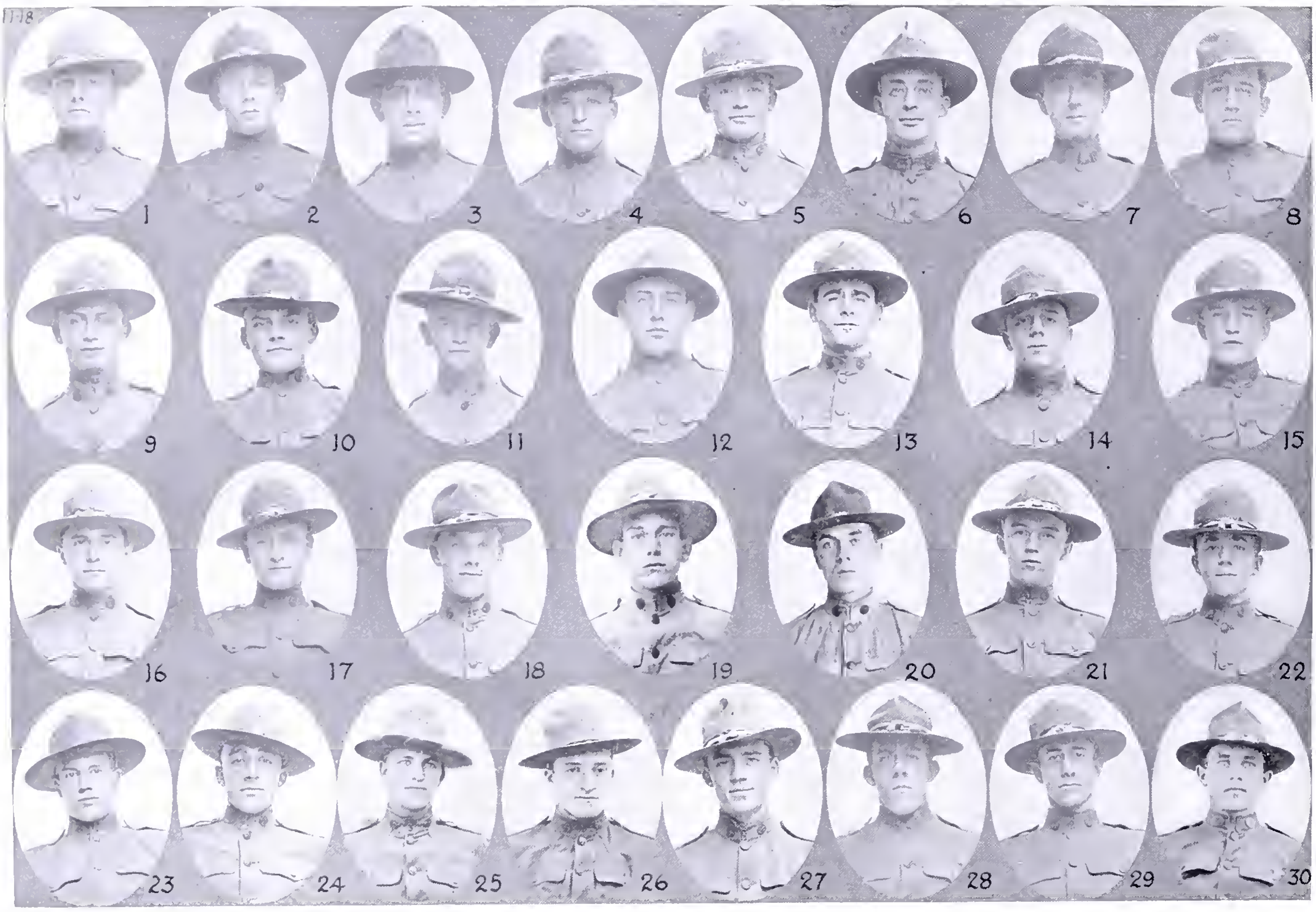
First Lieutenant William R. Thomas
Dental Surgeon

First Lieutenant George L. Quinn
Dental Surgeon



Headquarters Company, 1st Pennsylvania Infantry

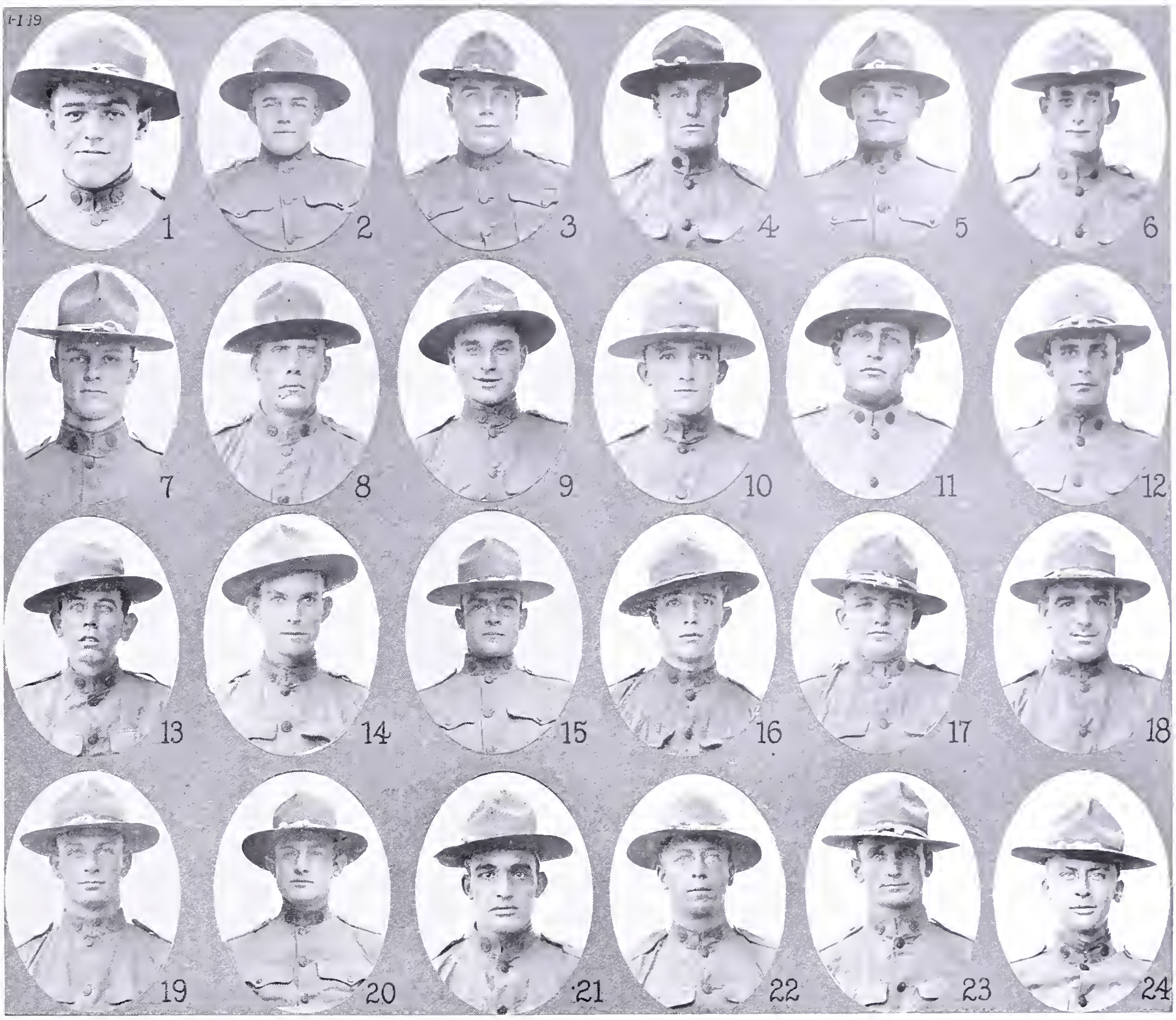
1. Regimental Sgt.-Major Earl D. Shaffer.....Philadelphia
2. Battalion Sgt.-Major Charles H. Quarles...Philadelphia
3. Battalion Sergeant-Major Herbert Madara..Philadelphia
4. Battalion Sergeant-Major Albert V. Gee.....Philadelphia
5. Band Leader Benjamin F. Maurer..........Philadelphia
6. First Sergeant Herbert J. Otto.............Philadelphia
7. Asst. Band Ldr. George E. Nonnamaker, Pensauken, N. J.
8. Sergeant-Bugler Leon W. Little............Philadelphia
9. Color Sergeant Wm. J. Carroll.............Philadelphia
10. Color Sergeant James Prentice, Jr...........Philadelphia
11. Supply Sergeant William T. Quay...........Philadelphia
12. Mess Sergeant William W. Biddison.........Philadelphia
13. Sergeant William H. Kohlmeyer............Philadelphia
14. Stable Sergeant William J. Camm............Philadelphia
15. Band Sergeant Charles S. Douglass.........Philadelphia
16. Band Sergeant Bernhart Miller . Philadelphia
17. Band Corporal Raymond Dodderer Norwood, Pa.
18. Band Corporal George F. Braunwart Philadelphia
19. Band Corporal Warren L. Schearer .Philadelphia
20. Horseshoer John J. McGuigan Philadelphia
21. Cook Frank Schultz. . . . Philadelphia
22. Cook Joseph Banz.... . . Philadelphia
23. First-class Musician Francis Bridgen .Philadelphia
24. First-class Musician John H. Kirschner Philadelphia
25. Second-class Musician John Dembowsky .Camden, N. J.
26. Second-class Musician Harold H. Wellman...Philadelphia
27. Second-class Musician William J. Nuttall. . Philadelphia
28. Second-class Musician Alfred G. Proud. ....Philadelphia
29. Third-class Musician Thomas C. Bebb....Edwardsville, Pa.



Headquarters Company, 1st Pennsylvania Infantry

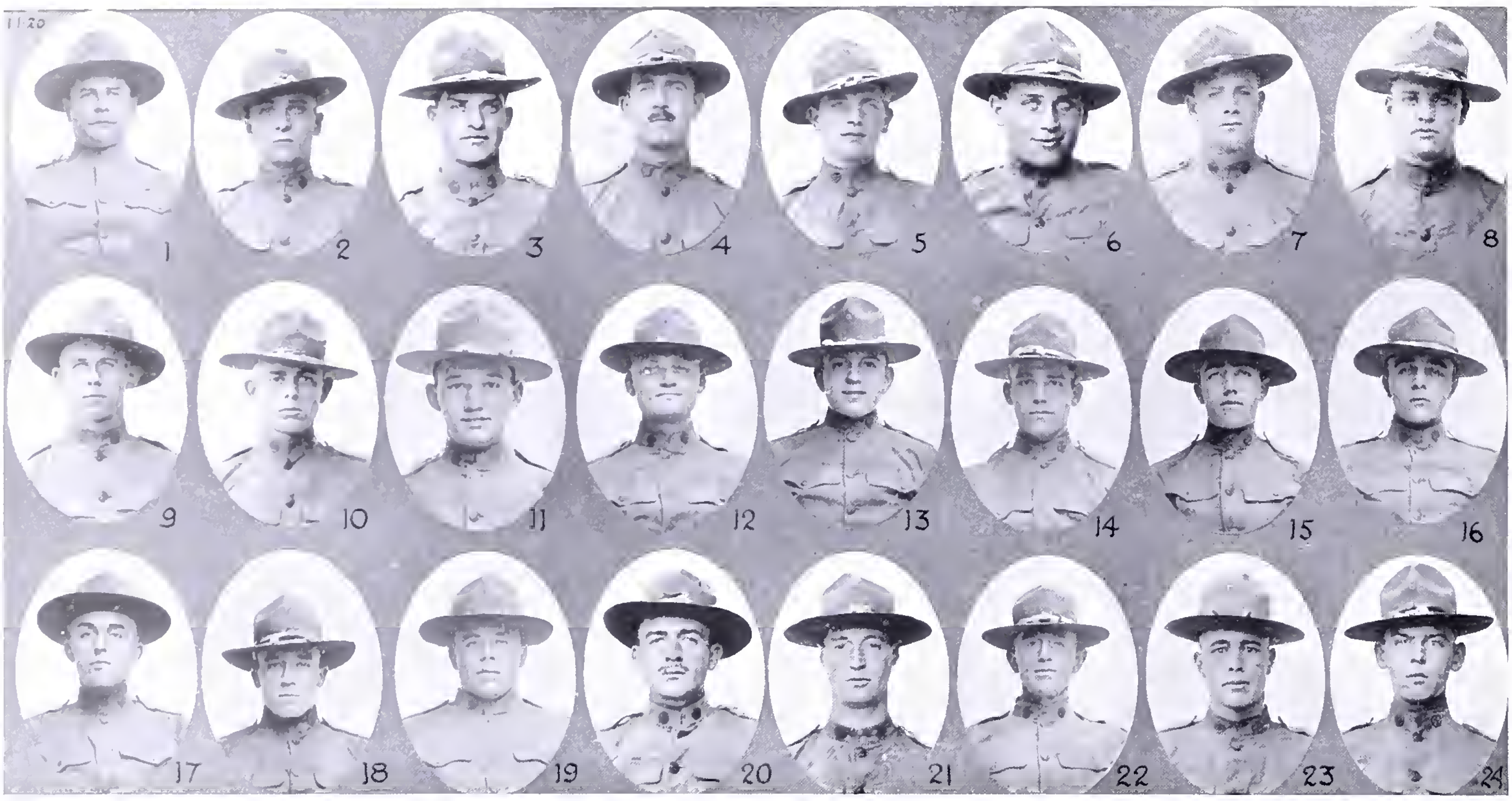
(CONTINUED)

1.	Third-class Musician J. W. Brand	Philadelphia
2.	Third-class Musician Samuel Dawson	Philadelphia
3.	Third-class Musician James E. Didio	Philadelphia
4.	Third-class Musician Walter J. Enoch	Philadelphia
5.	Third-class Musician James D. Frazer	Philadelphia
6.	Third-class Musician George W. Jones	Camden, N J.
7.	Third-class Musician Albert W. Jones	Philadelphia
8.	Third-class Musician Lloyd E. Miller	Philadelphia
9.	Third-class Musician Paul R. Reichelt	Philadelphia
10.	Third-class Musician Anthony Roman	Manayunk, Pa.
11.	Third-class Musician Lawrence W. Sheehan,	Philadelphia
12.	Third-class Musician George S. Smith	Gladwyn, Pa.
13.	First-class Musician Frederick Kaufman	Philadelphia
14.	Private Edw. C. Bradfield	Philadelphia
15.	Private Samuel D. Nichols	Philadelphia
16.	Private Raymond S. Kraft	Philadelphia
17.	Private Lawrence W. Reynolds	Glenolden, Pa.
18.	Private Howard S. Atkinson	Philadelphia
19.	Private William A. Jones	Philadelphia
20.	Private Jesse M. Kline	Shamokin, Pa.
21.	Private Thomas M. Nichols	Philadelphia
22.	Private Calvin H. Randolph	Philadelphia
23.	Private William J. Ruddell	Eddystone, Pa.
24.	Private Ralph E. Spencer	Philadelphia
25.	Private George H. Taylor	Wilkes-Barre, Pa.
26.	Private Harry Van Osten	Philadelphia
27.	Private John A. Knight	Philadelphia
28.	Private Harry Becker	Philadelphia
29.	Private Frank Berkenstock	Philadelphia
30.	Private Victor T. Bennett	Philadelphia



Supply Company, 1st Pennsylvania Infantry

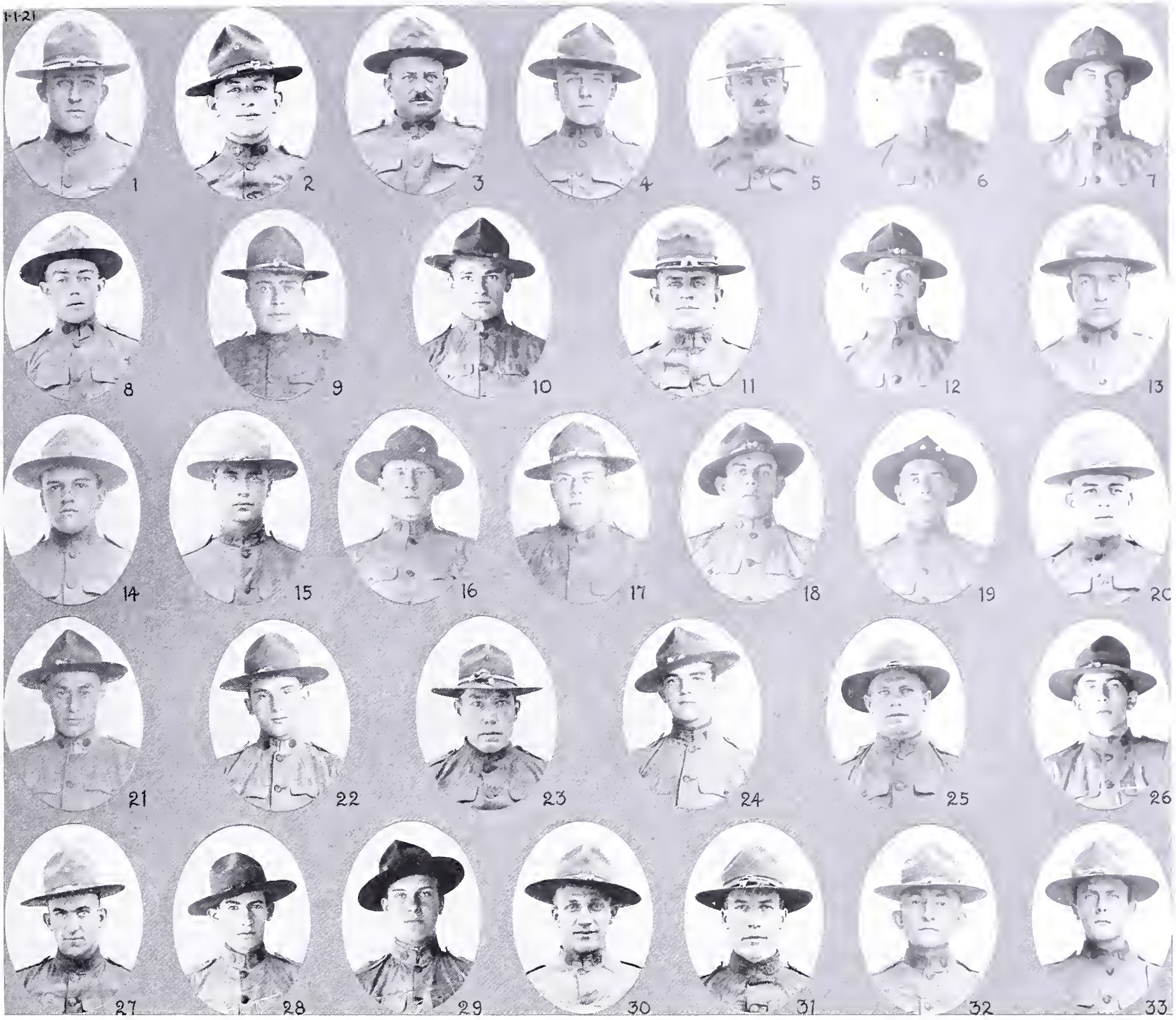
1.	Reg. Supply Ser. Frank G. Walker	Philadelphia
2.	Reg. Supply Ser. Norman J. Malone	Philadelphia
3.	Reg. Supply Ser. Henry E. Gammons	Philadelphia
4.	First Sergeant Lewis L. Clapper	Philadelphia
5.	Mess Sergeant George J. Ensslen	Philadelphia
6.	Stable Sergeant James G. McQuiston	Narberth, Pa.
7.	Corporal Carlisle W. Taylor	Philadelphia
8.	Horseshoer Alonzo W. Dill	Philadelphia
9.	Saddler Hugh J. Gallagher	Philadelphia
10.	Cook Charles Knecht	Philadelphia
11.	Wagoner Lewis E. Allen	Philadelphia
12.	Wagoner Arthur W. Balliet	Philadelphia
13.	Wagoner Henry H. Battin	Media, Pa.
14.	Wagoner Emanuel Carr, Jr.	Philadelphia
15.	Wagoner Vernon C. Brown	Philadelphia
16.	Wagoner Charles E. Coleman	Cincinnati, Ohio
17.	Wagoner Jay E. Connelly	Philadelphia
18.	Wagoner William J. Cox	Philadelphia
19.	Wagoner Frederick A. Evans	Philadelphia
20.	Wagoner Mahlon R. Heisey	Philadelphia
21.	Wagoner George H. Imhof	Philadelphia
22.	Wagoner Edward Keiter	Philadelphia
23.	Wagoner William G. Liming	Philadelphia
24.	Wagoner George H. Lukens, Jr.	Philadelphia



Supply Company, 1st Pennsylvania Infantry

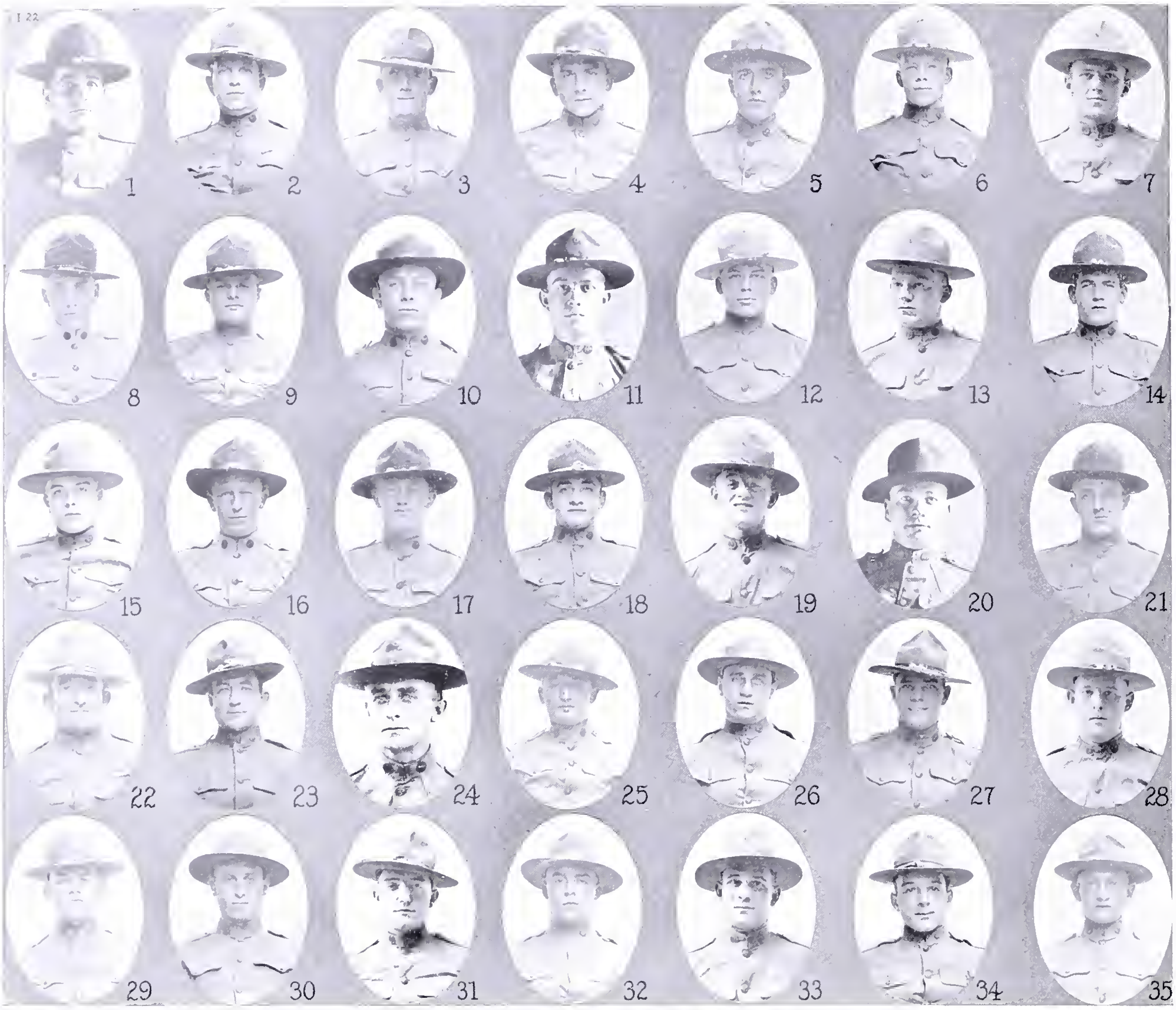
(CONTINUED)

1.	Wagoner Hugh J. Murray	Philadelphia
2.	Wagoner Raymond S. Peters	Philadelphia
3.	Wagoner Samuel Rafferty	Philadelphia
4.	Wagoner Clinton T. Richardson	Philadelphia
5.	Wagoner Eark K. Robbins	Hartsville, Pa.
6.	Wagoner Charles Smith	Philadelphia
7.	Wagoner Wilmer Snyder	Philadelphia
8.	Wagoner Lester B. Spielman	Philadelphia
9.	Wagoner Francis H. Wallace	Philadelphia
10.	Wagoner Phillip Zeitz	Philadelphia
11.	Corporal John H. Todd	Philadelphia
12.	Corporal Norman S. Henry	Philadelphia
13.	Corporal Norman Jones	Philadelphia
14.	Private Francis P. Connelly	Philadelphia
15.	Private Ambrose Marsden	Philadelphia
16.	Private Joseph Dougherty	Philadelphia
17.	Private Gail L. Hook	Birdsboro, Pa.
18.	Private Elmer J. Stevenson	Philadelphia
19.	Private Benjamin F. Miller	Kennett Square, Pa.
20.	Private Francis L. Place	Ocean City, N. J.
21.	Private Joseph Hibbert	Chester, Pa.
22.	Wagoner Alexander Hamilton	Philadelphia
23.	Wagoner Howard E. Brooks	Philadelphia
24.	Wagoner David S. Ross	Philadelphia



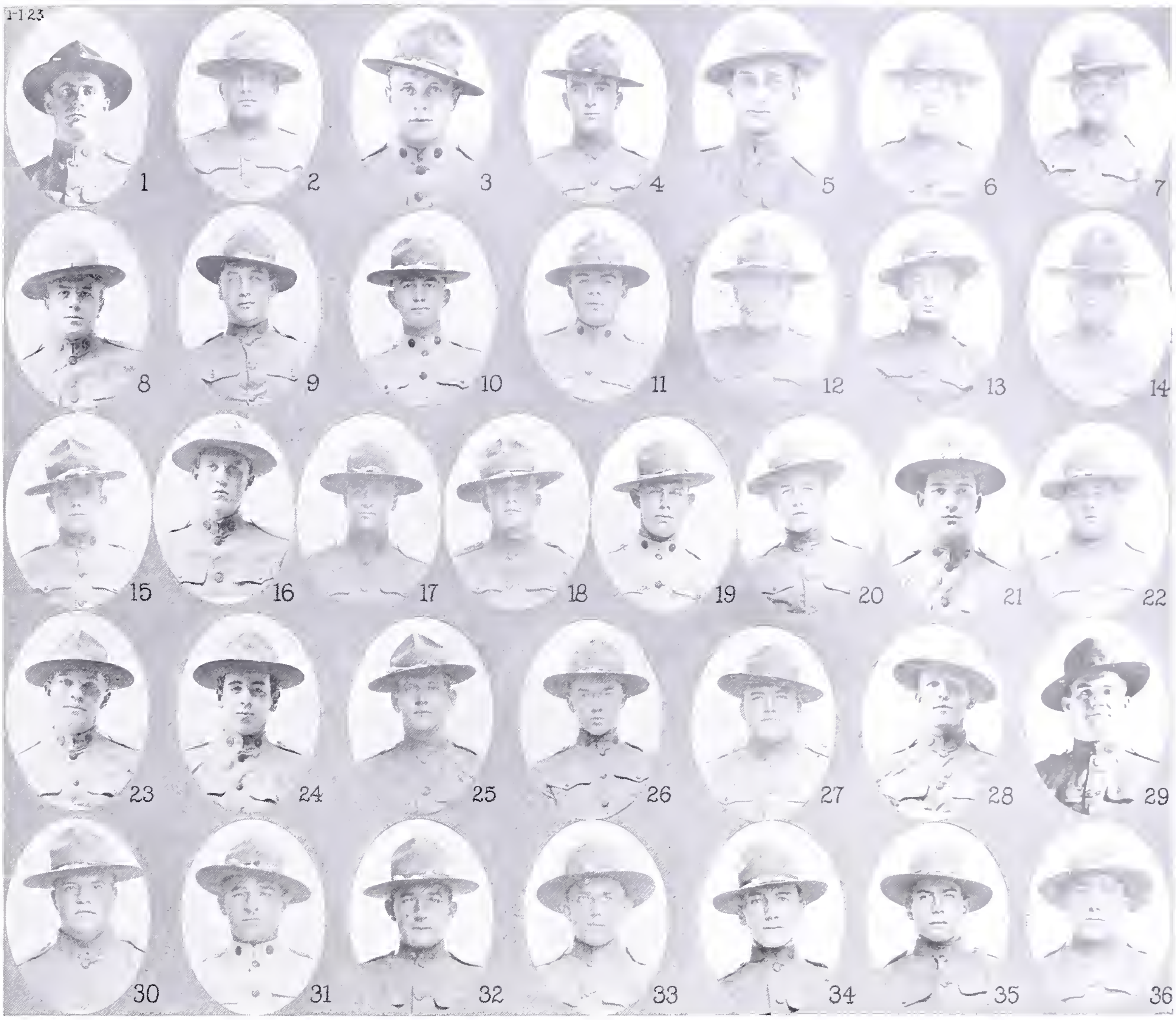
Sanitary Detachment, 1st Pennsylvania Infantry

1.	First-class Sergeant Leroy Jackson	Philadelphia
2.	Sergeant George Nestor	Philadelphia
3.	Sergeant Raleigh E. Suter	Philadelphia
4.	Sergeant Harry G. Huth	Watertown, Wis.
5.	First-class Private Harry Banzhof	Philadelphia
6.	First-class Private Harry Dawson	Philadelphia
7.	First-class Private Claude Garland	Philadelphia
8.	First-class Private Lawrence Himes	Philadelphia
9.	First-class Private Harry Null	Philadelphia
10.	First-class Private Harold Walters	Philadelphia
11.	First-class Private Leroy Webb	Philadelphia
12.	Private Edwin Barr	Philadelphia
13.	Private Watson Bradley	Philadelphia
14.	Private Eugene Carpenter, Jr.	Darby, Pa.
15.	Private William B. Clare	Philadelphia
16.	Private Walter Delle	York, Pa.
17.	Private Thorolf Gunderson	Philadelphia
18.	Private Robert Herbstreit	Philadelphia
19.	Private Frank Hoose, Jr.	Philadelphia
20.	Private Samuel Kauffman	Philadelphia
21.	Private Jacob Klein	Philadelphia
22.	Private Gordon Kuhns	Trevorton, Pa.
23.	Private Jefferson D. Lee	Philadelphia
24.	Private Harry Maguire	Philadelphia
25.	Private Albin Pearson	Philadelphia
26.	Private Swen Rosedale	Philadelphia
27.	Private Harold Speakman	Narberth, Pa.
28.	Private Robert Thompson	Philadelphia
29.	Private Edgar Torkelson	Philadelphia
30.	Private Leslie Webb	Philadelphia
31.	Private Oscar Welsh	Bryn Mawr, Pa.
32.	Private Fred Zerbe	Philadelphia
33.	Private Frank M. Thomas	West Chester, Pa.



Machine Gun Company, 1st Pennsylvania Infantry

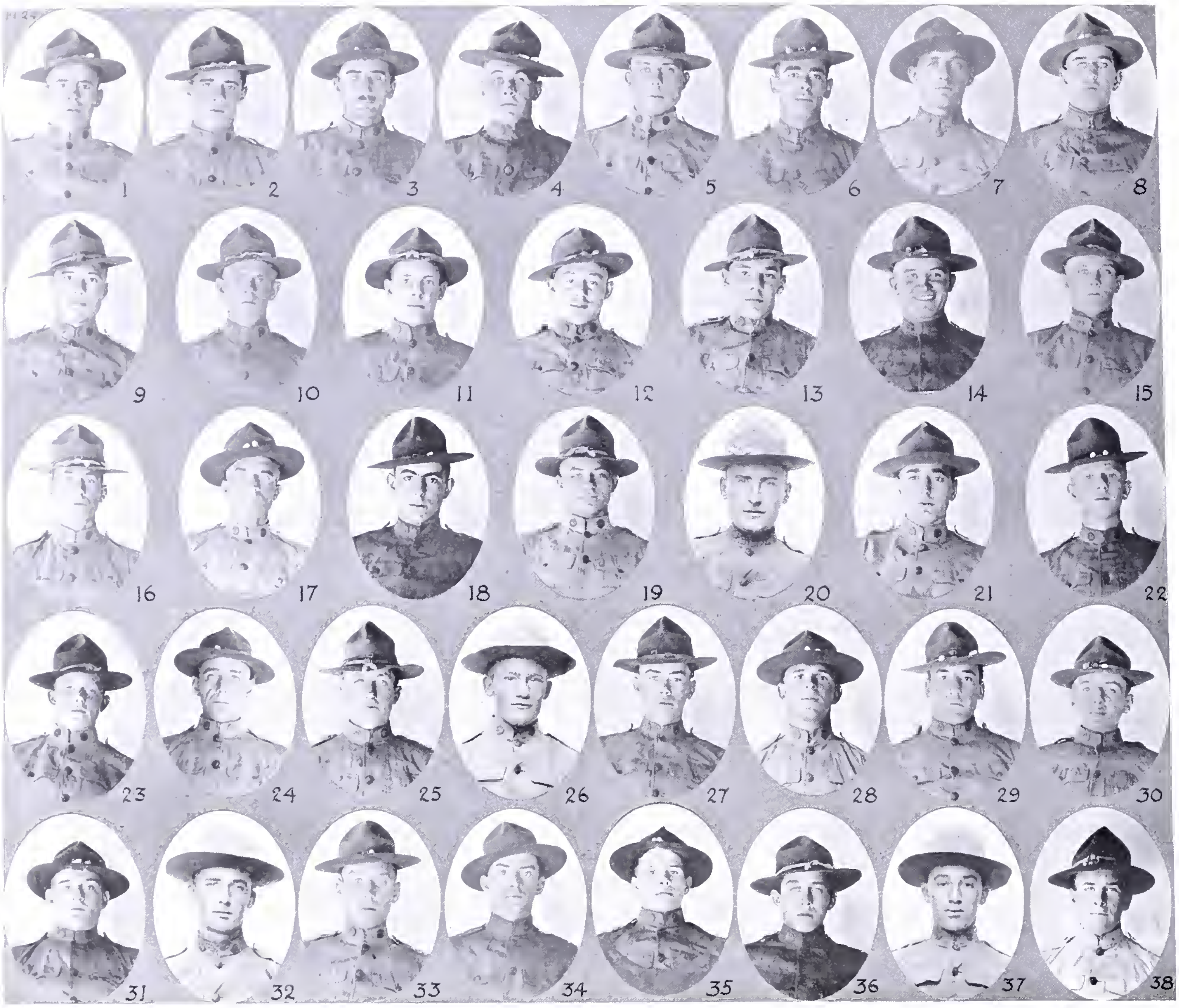
1.	First Sergeant John Meracle	Philadelphia
2.	Mess Sergeant Felix J. Elliott	Philadelphia
3.	Supply Sergeant Hugh J. Callaghan	Scranton, Pa.
4.	Stable Sergeant Edwin J. Lloyd	Philadelphia
5.	Horseshoer Cyrus C. Covalt	Philadelphia
6.	Sergeant Alric E. Wallgren	Philadelphia
7.	Sergeant Herbert E. Swearer	Windber, Pa.
8.	Sergeant L. A. R. Lichetti, Jr.	Philadelphia
9.	Sergeant Howard J. Meyer	Trenton, N. J.
10.	Sergeant Joseph Brennan	Philadelphia
11.	Sergeant Robert L. Hunsworth	Philadelphia
12.	Sergeant John W. Kimes	Philadelphia
13.	Corporal William H. Lunn	Philadelphia
14.	Corporal Wallace H. Kelly	Philadelphia
15.	Corporal Clarence W. Battersby	Philadelphia
16.	Corporal John E. Armitage	Philadelphia
17.	Corporal Alfred W. MacBride	Philadelphia
18.	Corporal Walter H. Tietz	Philadelphia
19.	Corporal Harry S. Burr	Philadelphia
20.	Corporal Patrick J. Smith	Philadelphia
21.	Mechanic George L. Gahagin	Philadelphia
22.	Mechanic James A. Thornton	Philadelphia
23.	Cook Wm. F. Stout	Philadelphia
24.	Cook Howard Young	Philadelphia
25.	Bugler Albert Weitsman	Philadelphia
26.	First-class Private George E. Davis	Philadelphia
27.	First-class Private Fayette V. Dreyer	Colwyn, Pa.
28.	First-class Private Thomas W. Goldsmith	Philadelphia
29.	First-class Private Thomas M. McGinn	Philadelphia
30.	First-class Private Patrick Moran	Chester, Pa.
31.	First-class Private Herman E. Polenz	Philadelphia
32.	First-class Private Edward O'N. Quinn	Philadelphia
33.	First-class Private David L. Scott	Philadelphia
34.	First-class Private Elmer M. Taylor	Lawndale, Pa.
35.	Private John B. Adolphus	Philadelphia



Machine Gun Company, 1st Pennsylvania Infantry

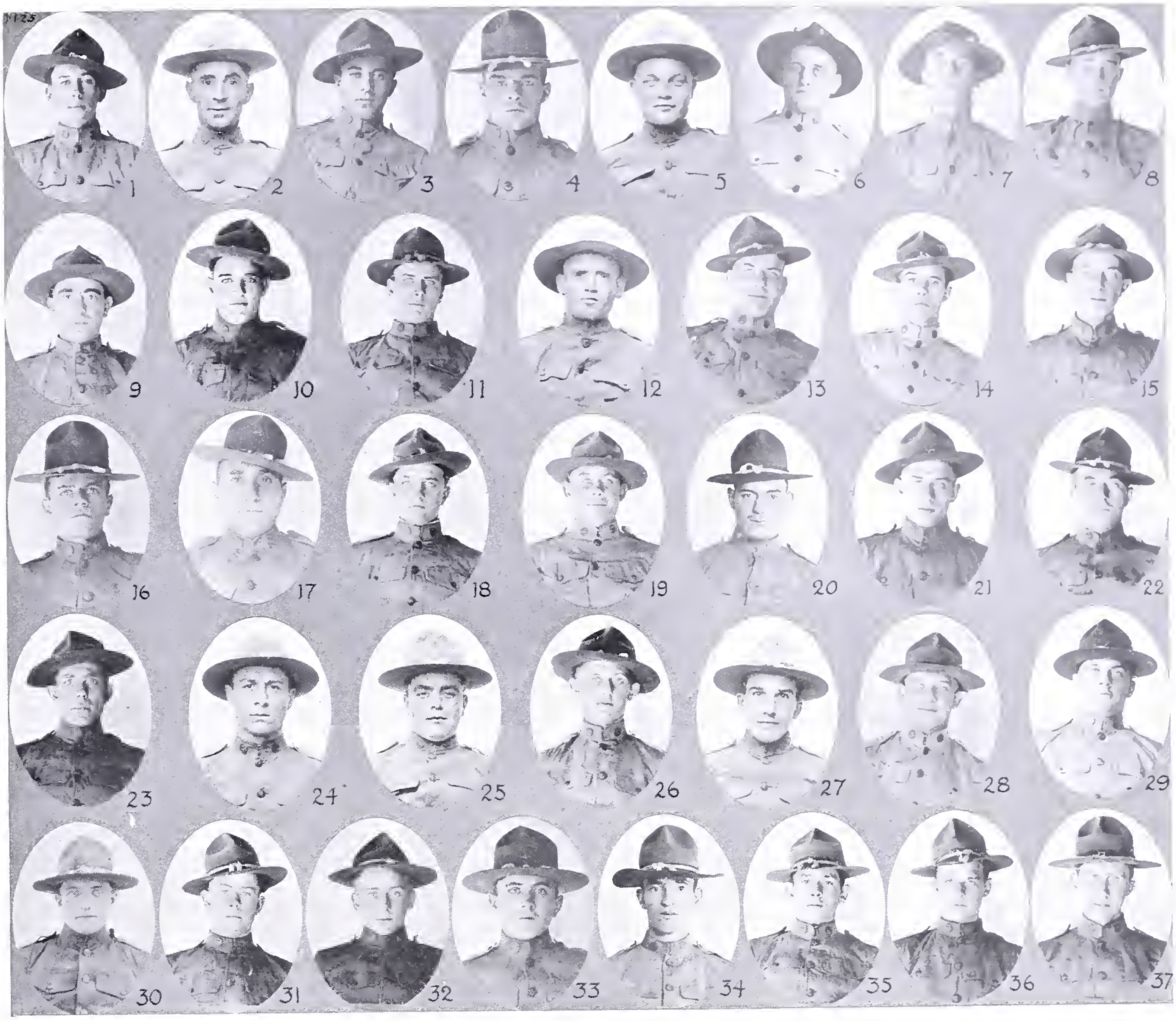
(CONTINUED)

1.	Private John B. Bender	Philadelphia
2.	Private Archibald B. Cooper, Jr.	Colwyn, Pa.
3.	Private Leslie R. Craig	Lansdowne, Pa.
4.	Private Harry Cribben	Philadelphia
5.	Private Theodore C. Fisher	Philadelphia
6.	Private Raymond A. Fox	White Haven, Pa.
7.	Private John Gallagher	Philadelphia
8.	Private Arthur Gray	Bryn Mawr, Pa.
9.	Private Charles E. Hamel	Philadelphia
10.	Private Robert Havens	Philadelphia
11.	Private George K. Hopple	Philadelphia
12.	Private John D. Hutchinson, Jr.	Philadelphia
13.	Private Edgar H. Kimes	Philadelphia
14.	Private John Meskill	Philadelphia
15.	Private Albert J. Murray	Philadelphia
16.	Private Benjamin Owens	Philadelphia
17.	Private William Platanis	Collingdale, Pa.
18.	Private Albert T. Rees	Philadelphia
19.	Private Charles R. Seibold	Philadelphia
20.	Private Alden Stackhouse	Philadelphia
21.	Private Roy Starner	Philadelphia
22.	Private James M. Stewart	Philadelphia
23.	Private James T. Taylor	Lansdowne, Pa.
24.	Private James L. Toner	Philadelphia
25.	Private William B. Unruhe	Philadelphia
26.	Private William F. Valentin	Philadelphia
27.	Private William A. Washburne, Jr.	Philadelphia
28.	Private Andrew Watson	Philadelphia
29.	Private John C. Welch, Jr.	Philadelphia
30.	Private Edw. Gravell	Philadelphia
31.	Private Abe Senecoff	Philadelphia
32.	Private Edward Smith	Philadelphia
33.	Private Wm. Johnson	Philadelphia
34.	Private Russel E. Smith	Philadelphia
35.	Private William W. Moore	Philadelphia
36.	Private William S. Barbour	Philadelphia



Company A, 1st Pennsylvania Infantry

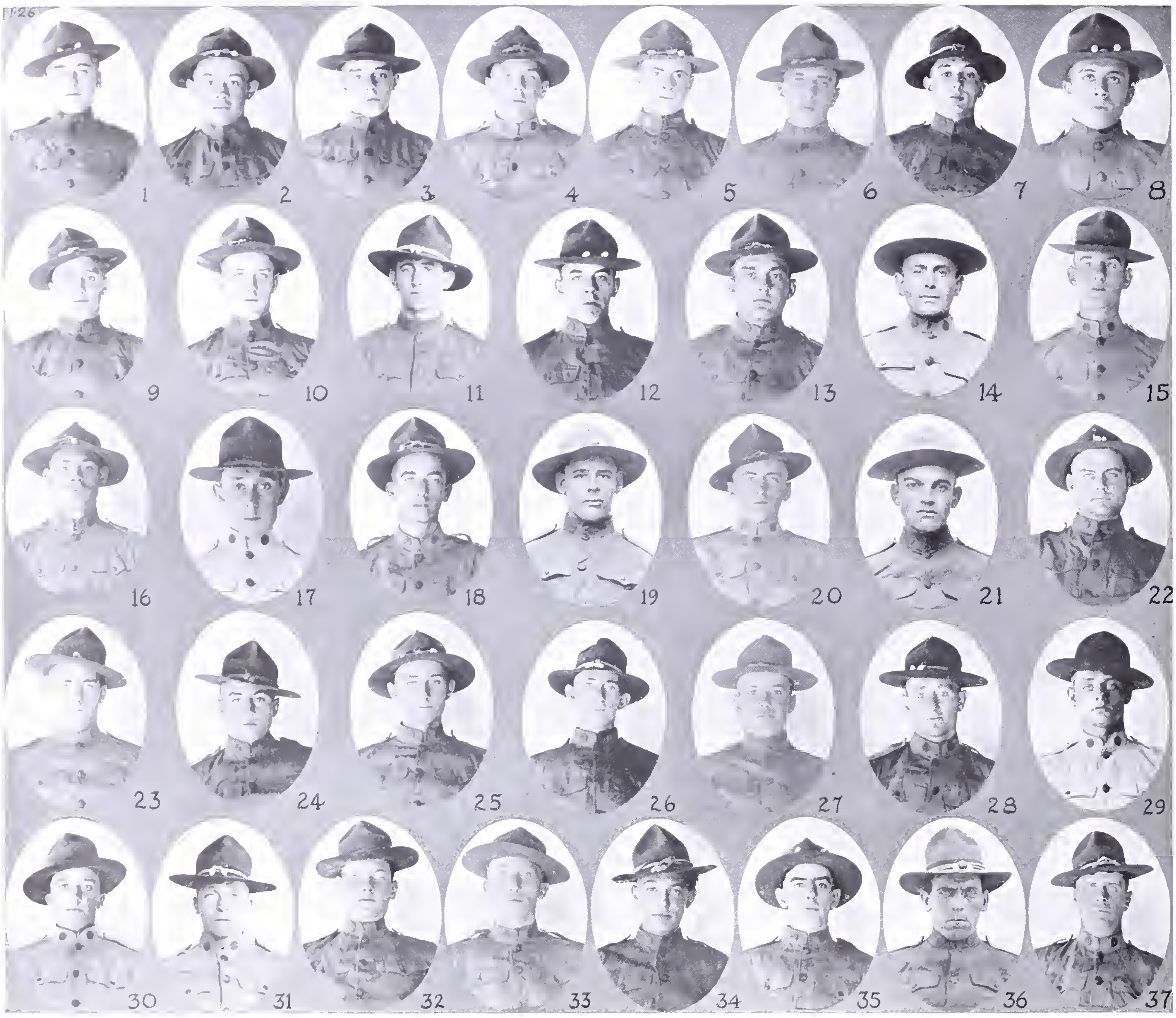
1.	First Sergeant John A. Dever	Philadelphia
2.	Mess Sergeant John J. Shanahan	Philadelphia
3.	Supply Sergeant James G. Charles	Philadelphia
4.	Sergeant John P. Connell	Philadelphia
5.	Sergeant Edward J. Smith	Philadelphia
6.	Sergeant John J. MacVeigh, Jr.	Philadelphia
7.	Sergeant Frank P. Walsh	Philadelphia
8.	Sergeant Edward J. Quinlan	Philadelphia
9.	Corporal Edward Dwyer	Philadelphia
10.	Corporal Charles Sine	Mapleshade, N. J.
11.	Corporal Andrew R. McLaughlin	Philadelphia
12.	Corporal Irving S. Clair	Philadelphia
13.	Corporal George A. Goehring	Philadelphia
14.	Corporal Thomas Feeney	Philadelphia
15.	Corporal Ferdinand J. Koehler	Philadelphia
16.	Cook Joseph Leadbeater	Philadelphia
17.	Mechanic William Griffin	Philadelphia
18.	Bugler Phillip Goodridge	Philadelphia
19.	Bugler Samuel W. White	Philadelphia
20.	First-class Private Hiram Barnes	Philadelphia
21.	First-class Private Harry Bingham	Philadelphia
22.	First-class Private Joseph J. Bisel	Philadelphia
23.	First-class Private George B. Craig	Philadelphia
24.	First-class Private Clarence W. Hettrick,	Royersford, Pa.
25.	First-class Private John Loudenslager	Fox Chase, Pa.
26.	First-class Private Samuel Moore	Philadelphia
27.	First-class Private John E. Murray	Philadelphia
28.	First-class Private Edward Quinn	Philadelphia
29.	First-class Private Edward Yates	Philadelphia
30.	Private Earle R. Allison	Quakertown, Pa.
31.	Private Louis Babe	Philadelphia
32.	Private William Barrett	Bristol, Pa.
33.	Private William C. Bauer	Philadelphia
34.	Private Leo M. Bergan	Philadelphia
35.	Private Rudolph E. Birkmaier	Langhorne, Pa.
36.	Private Roscoe Blank	Telford, Pa.
37.	Private Louis L. Boweers	Philadelphia
38.	Private James P. Brennan	Philadelphia



Company A, 1st Pennsylvania Infantry

(CONTINUED)

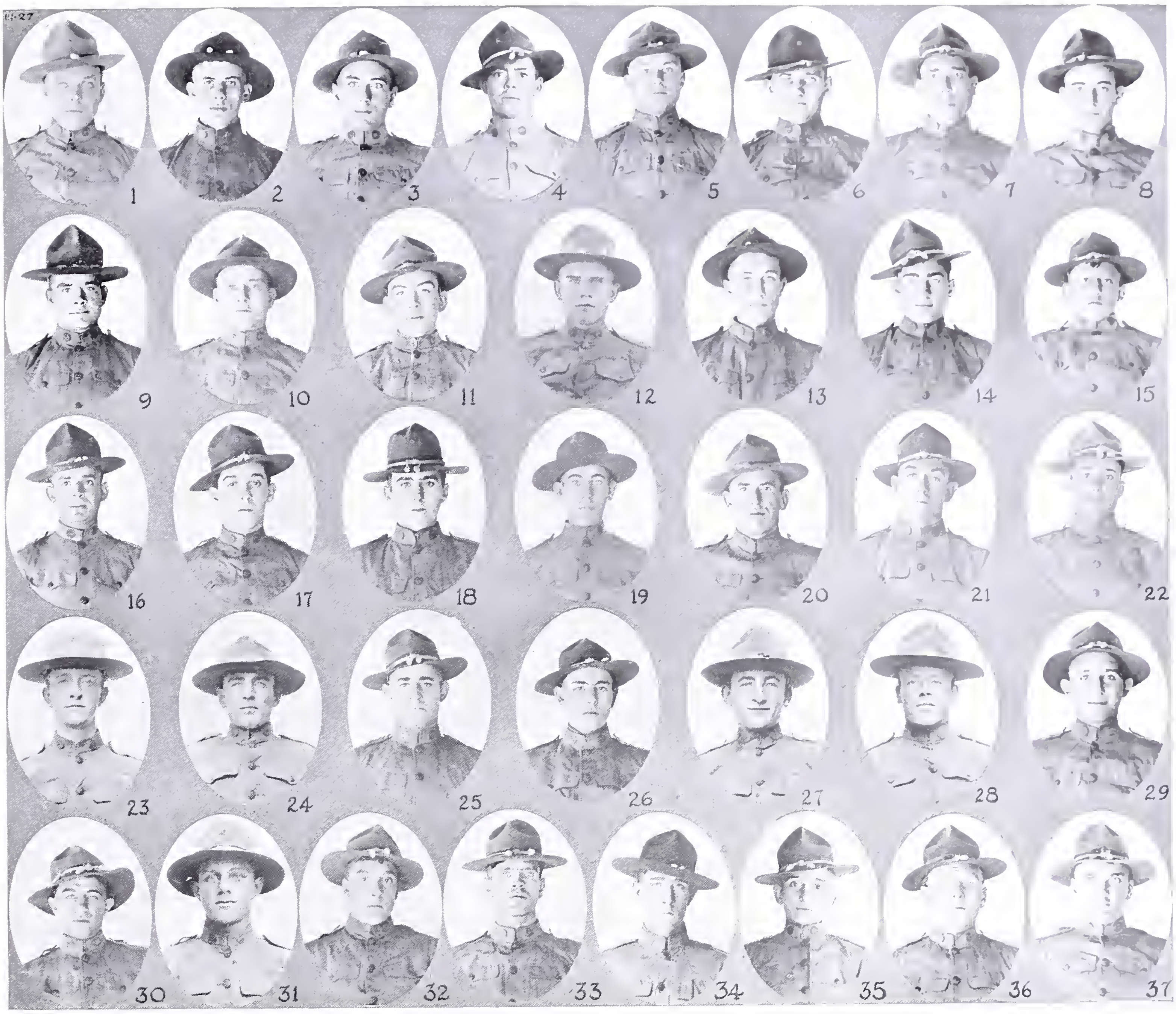
1.	Private Albert Bright	Philadelphia
2.	Private James G. Burns	Philadelphia
3.	Private John J. Caram	Cambria City, Pa.
4.	Private J. L. Champion	Johnstown, Pa.
5.	Private James Carbarry	Philadelphia
6.	Private William C. Chester	Philadelphia
7.	Private Ralph H. Christy	Philadelphia
8.	Private Joseph I. Clarke	Moosic, Pa.
9.	Private William B. Conley	Philadelphia
10.	Private William A. Delaney	Philadelphia
11.	Private Peter F. Deveraeux	Philadelphia
12.	Private John D. Devlin	Philadelphia
13.	Private Carles Donegan	Philadelphia
14.	Private Thomas A. Donnelley	Philadelphia
15.	Private John R. Dronsfield	Philadelphia
16.	Private A. Dowd	Philadelphia
17.	Private William C. Eberle	Philadelphia
18.	Private Frank L. Egner	Quakertown, Pa.
19.	Private William Farley	Philadelphia
20.	Private Frank J. Flannery	Philadelphia
21.	Private James G. Fleming	Philadelphia
22.	Private Le Roy P. Flynn	Philadelphia
23.	Private Harry L. Frissel	Washington, D. C.
24.	Private Irvin L. Fromme	Philadelphia
25.	Private John F. Galen	Chestnut Hill, Pa.
26.	Private George G. Gerhart	Perkasie, Pa.
27.	Private Elmer D. Garis	Soudertown, Pa.
28.	Private Louis S. Goldfus	Philadelphia
29.	Private Raymond L. Goodman	Philadelphia
30.	Private Millard C. Goodroe	Philadelphia
31.	Private Anthony C. Grogan	Philadelphia
32.	Private Frank T. Groh	Quakertown, Pa.
33.	Private Joseph Gee	Philadelphia
34.	Private Clifford B. Harbridge	Philadelphia
35.	Private Frank B. Harbridge	Philadelphia
36.	Private Rutherford Harland	Philadelphia
37.	Private Joseph M. Harvey	Philadelphia



Company A, 1st Pennsylvania Infantry

(CONTINUED)

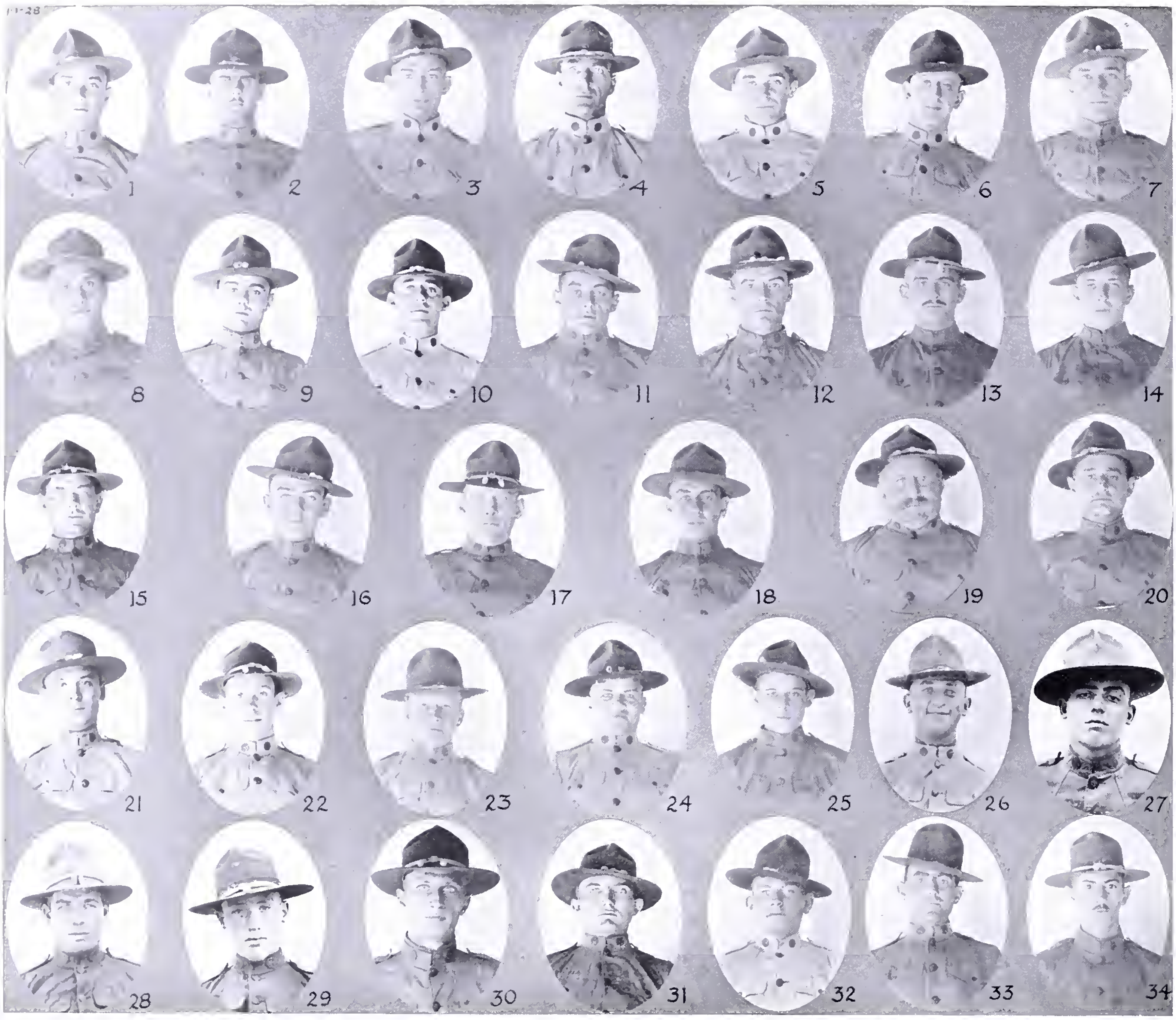
1.	Private Francis H. Hauer	Philadelphia
2.	Private Raymond W. Heller	Quakertown, Pa.
3.	Private Warren Henderson	Philadelphia
4.	Private James P. Higgins	Philadelphia
5.	Private Howard E. Hoag	Philadelphia
6.	Private Francis D. Howard	Pleasantville, N. J.
7.	Private Harry C. Hoyle	Philadelphia
8.	Private G. Stafetas	Philadelphia
9.	Private William Jerdan	Philadelphia
10.	Private William E. Jones	Philadelphia
11.	Private John T. Joyce	Philadelphia
12.	Private Wallace W. Keller	Quakertown, Pa.
13.	Private Henry L. Kile	Soudertown, Pa.
14.	Private John J. Kirby	Philadelphia
15.	Private Harry Kleinstuber	Philadelphia
16.	Private Mandus Kletcing	Lansdale, Pa.
17.	Private H. Leedom	Philadelphia
18.	Private John L. Lebengood	Philadelphia
19.	Private James C. Lloyd	Philadelphia
20.	Private Richard A. Lorz	Philadelphia
21.	Private James M. Loughridge	Sellersville, Pa.
22.	Private James Loughlin	Philadelphia
23.	Private J. J. Malone	Philadelphia
24.	Private Charles F. Mahon	Philadelphia
25.	Private Gordon E. Maloney	Philadelphia
26.	Private James H. McClay	Philadelphia
27.	Private Thomas J. McKeon	Philadelphia
28.	Private James J. McLaughlin	Philadelphia
29.	Private Frank E. Markley	Philadelphia
30.	Private George Markham	Philadelphia
31.	Private Albert J. Martin	Philadelphia
32.	Private John P. Martin	Philadelphia
33.	Private Frank R. Montgomery, Jr.	Philadelphia
34.	Private James Morrow	Philadelphia
35.	Private Edward J. Mulligan	Morton, Pa.
36.	Private Richard W. Murley	Philadelphia
37.	Private Thomas J. Murray	Lester, Pa.



Company A, 1st Pennsylvania Infantry

(CONTINUED)

1.	Private Clifford T. Naylor	Trenton, N. J.
2.	Private Marvin R. Nice	Telford, Pa.
3.	Private Conrad E. Nolte	Philadelphia
4.	Private Harry F. Nuneviller	Philadelphia
5.	Private William D. Pfeifle	Rich Hill, Pa.
6.	Private William F. O'Donnell	Philadelphia
7.	Private Dominick Pantone	Philadelphia
8.	Private Wallace R. Reid	Philadelphia
9.	Private Thomas C. Reed	Philadelphia
10.	Private Walter L. Reed	Philadelphia
11.	Private Charles Reilly	Philadelphia
12.	Private Joseph J. Reraback	Perkasie, Pa.
13.	Private Warren Royer	Soudertown, Pa.
14.	Private Francis L. Ryden	Philadelphia
15.	Private Martin E. Sacks	Perkasie, Pa.
16.	Private Harry Schuck	Philadelphia
17.	Private Thomas P. J. Shaw	Philadelphia
18.	Private Walter E. Smith	Sellersville, Pa.
19.	Private Spry A. Sparks	Philadelphia
20.	Private David Spickler	Philadelphia
21.	Private Joseph Talyor	Beaver Dam, Ky.
22.	Private John Toscher	Jersey City, N. J.
23.	Private Joseph E. Tracy	Philadelphia
24.	Private Frederick Tumbo	Philadelphia
25.	Private Samuel M. Turner	Philadelphia
26.	Private Jonathan Umholtz	Philadelphia
27.	Private James Wales	Philadelphia
28.	Private Andrew J. Ward	Philadelphia
29.	Private Charles R. Wasser	Philadelphia
30.	Private Cassell Wechter	Philadelphia
31.	Private Russel B. Wentzel	Telford, Pa.
32.	Private William P. Weiss	Philadelphia
33.	Private Julius F. Wilcox	Philadelphia
34.	Private Harold F. Wilkinson	Philadelphia
35.	Private Elmer M. Woolf	Philadelphia
36.	Private Edward Wroblewski	Milwaukee, Wis.
37.	Private R. Egner	Quakertown, Pa.



Company B, 1st Pennsylvania Infantry

1.	First Sergeant William J. Murphy	Philadelphia
2.	Supply Sergeant Joseph F. Miller	Philadelphia
3.	Sergeant Conrad P. Lieberman	Philadelphia
4.	Sergeant Reubin H. Oves	Philadelphia
5.	Sergeant W. H. Starkey	Bustleton, Pa.
6.	Sergeant Howard H. Parker	Philadelphia
7.	Corporal Richard H. Hague	Philadelphia
8.	Corporal George Kalman	Philadelphia
9.	Corporal Samuel Wasserman	Philadelphia
10.	Corporal George Phillipi	Philadelphia
11.	Corporal Adolph Denzel	Philadelphia
12.	Corporal Robert Livingston	Pennington, N. J.
13.	Corporal Herman Y. Broomhall	Philadelphia
14	Corporal Louis A. North	Bristol, Pa.
15.	Corporal Harry L. Greene	Manayunk, Pa.
16.	Mechanic Marshall Batchlor	Philadelphia
17.	Mechanic James B. Hynes	Philadelphia
18.	Cook Arthur C. W. Franke	Philadelphia
19.	Cook Frank U. Benner	Philadelphia
20.	Cook James J. Steich	Philadelphia
21.	Bugler John Prober	Philadelphia
22.	Bugler James E. Williams	Miami, Okla.
23.	First-class Private Daniel J. Ball	Philadelphia
24.	First-class Private Frank J. Brennen	Philadelphia
25.	First-class Private Joseph L. Day	Philadelphia
26.	First-class Private Samuel Glaser	Philadelphia
27.	First-class Private Harry Kelly	Philadelphia
28.	First-class Private Douglas Glenn	Philadelphia
29.	First-class Private Vincent Kelley	Philadelphia
30.	First-class Private James H. Lewis	Philadelphia
31.	First-class Private Orrie Lillard	Cynwyd, Pa.
32.	First-class Private Robert Marsh	Philadelphia
33.	First-class Private Daniel J. McConomy	Phoenixville, Pa.
34.	First-class Private Richard Newman	Philadelphia

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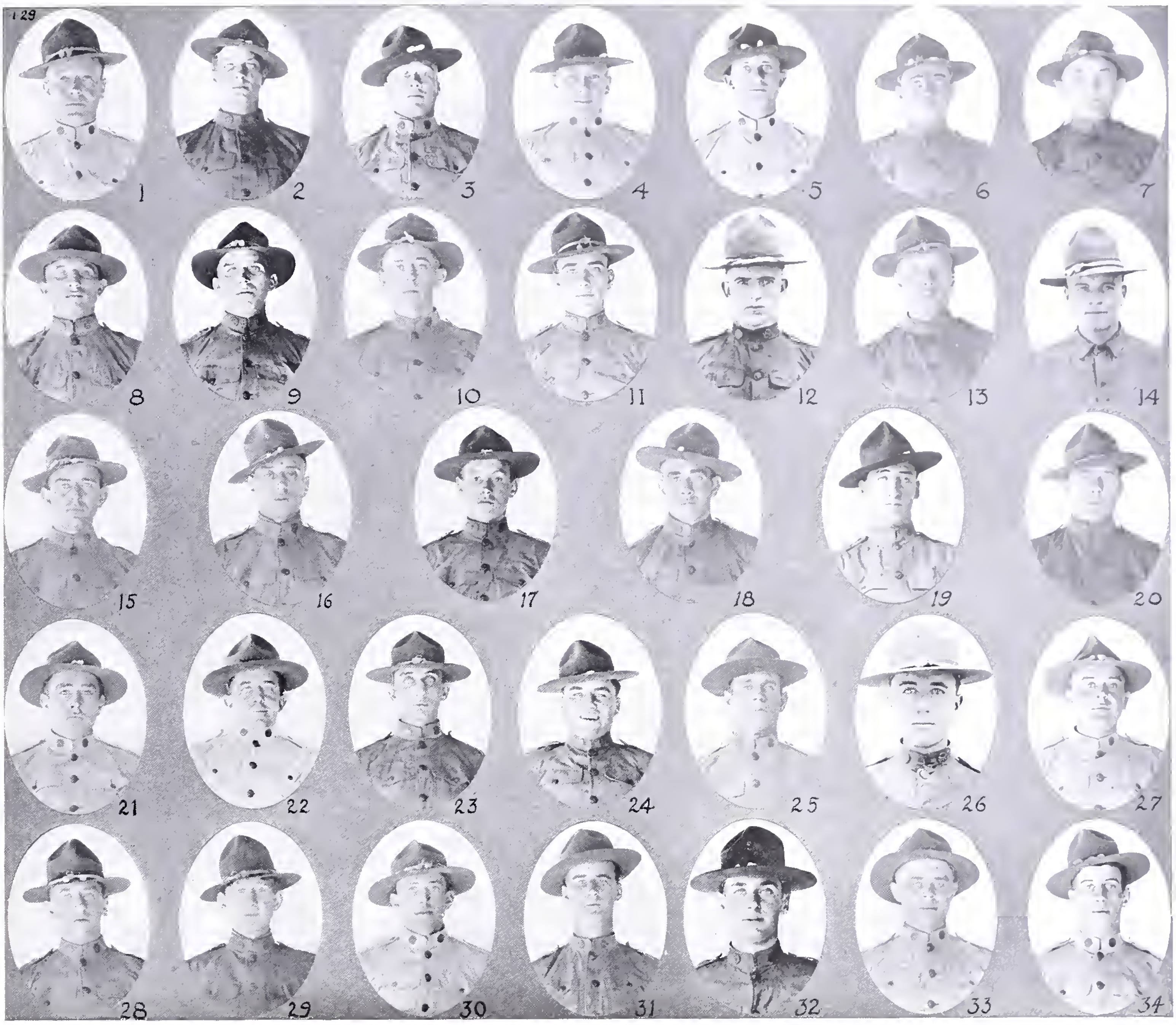
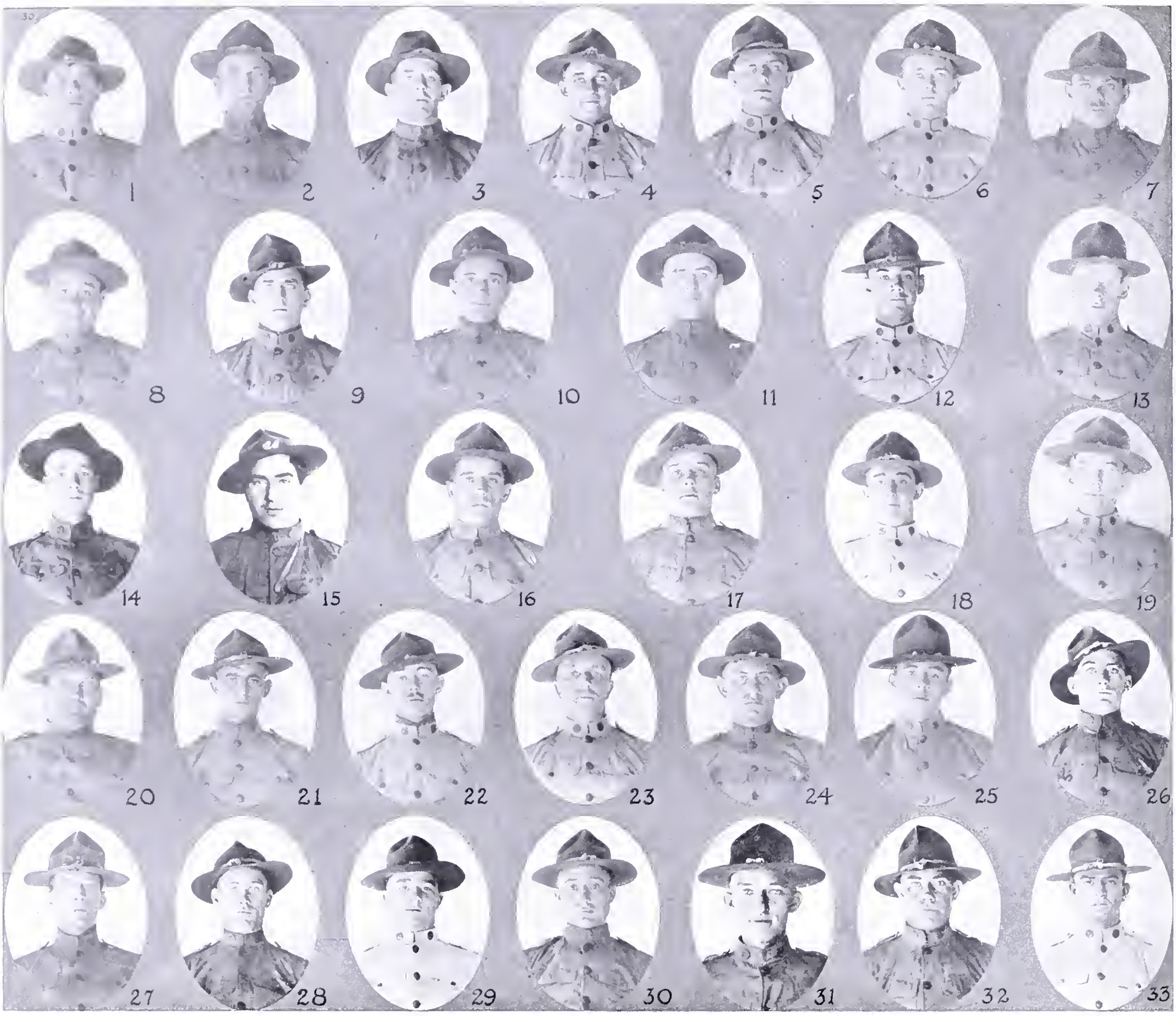


Company B, 1st Pennsylvania Infantry

(CONTINUED)

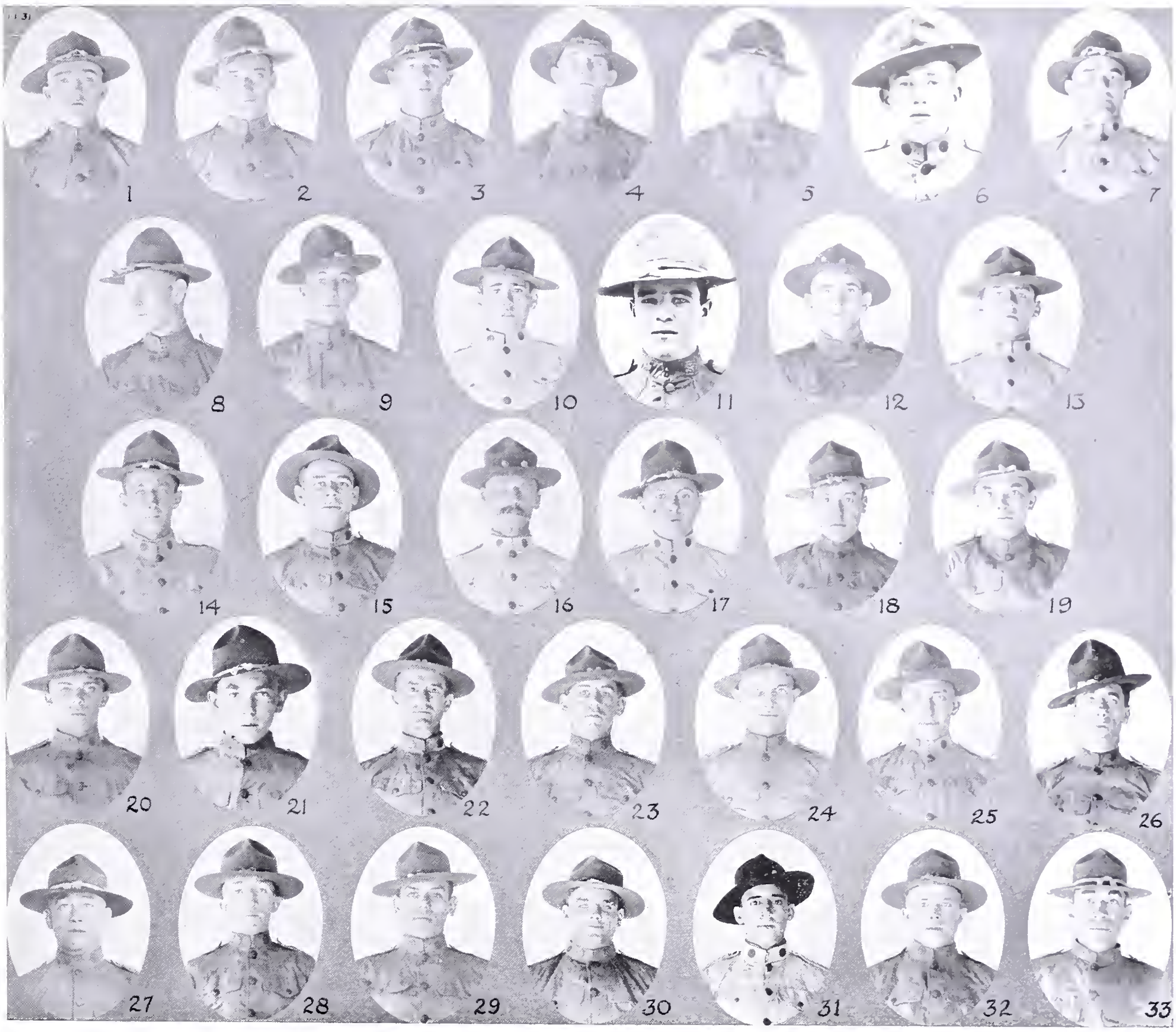
1.	First-class Private William Parker	Philadelphia
2.	First-class Private George Rathgeb	Philadelphia
3.	First-class Private Lewis R. Skeen	Philadelphia
4.	First-class Private Warren G. Snyder	Philadelphia
5.	First-class Private Harry J. Stone	Philadelphia
6.	Private Joseph T. Bailey	Philadelphia
7.	Private Matthew Barrow	Philadelphia
8.	Private Andrew Baskin	Philadelphia
9.	Private John Baskin	Philadelphia
10.	Private Fred Bietz	Bluebell, Pa.
11.	Private Francis J. Bird	Philadelphia
12.	Private Austin J. Blake	Philadelphia
13.	Private Carl E. Blumkist	Philadelphia
14.	Private Emanuel Boerner	Philadelphia
15.	Private Patrick J. Bonner	Morea, Pa.
16.	Private Samuel Boordman	Philadelphia
17.	Private Bernard A. Botson	Philadelphia
18.	Private John A. Brady	St. Mary's, Md.
19.	Private Edward J. Braner	Philadelphia
20.	Private William G. Carroll	Philadelphia
21.	Private John L. Clerc	Aiken, N. C.
22.	Private James T. Costigan	Philadelphia
23.	Private Ashton V. Coates	Philadelphia
24.	Private William C. Cornman	Philadelphia
25.	Private Joseph A. Crowley	Philadelphia
26.	Private Daniel H. Cummings	Philadelphia
27.	Private James J. Daly	New York City
28.	Private Joseph R. Daley	Philadelphia
29.	Private Ernest Davies	Philadelphia
30.	Private LeRoy E. Deberiner	Philadelphia
31.	Private John Dunlevy	Philadelphia
32.	Private J. A. Dougherty	Philadelphia
33.	Private Robert Eberts	Philadelphia
34.	Private George Farley	Philadelphia



Company B, 1st Pennsylvania Infantry

(CONTINUED)

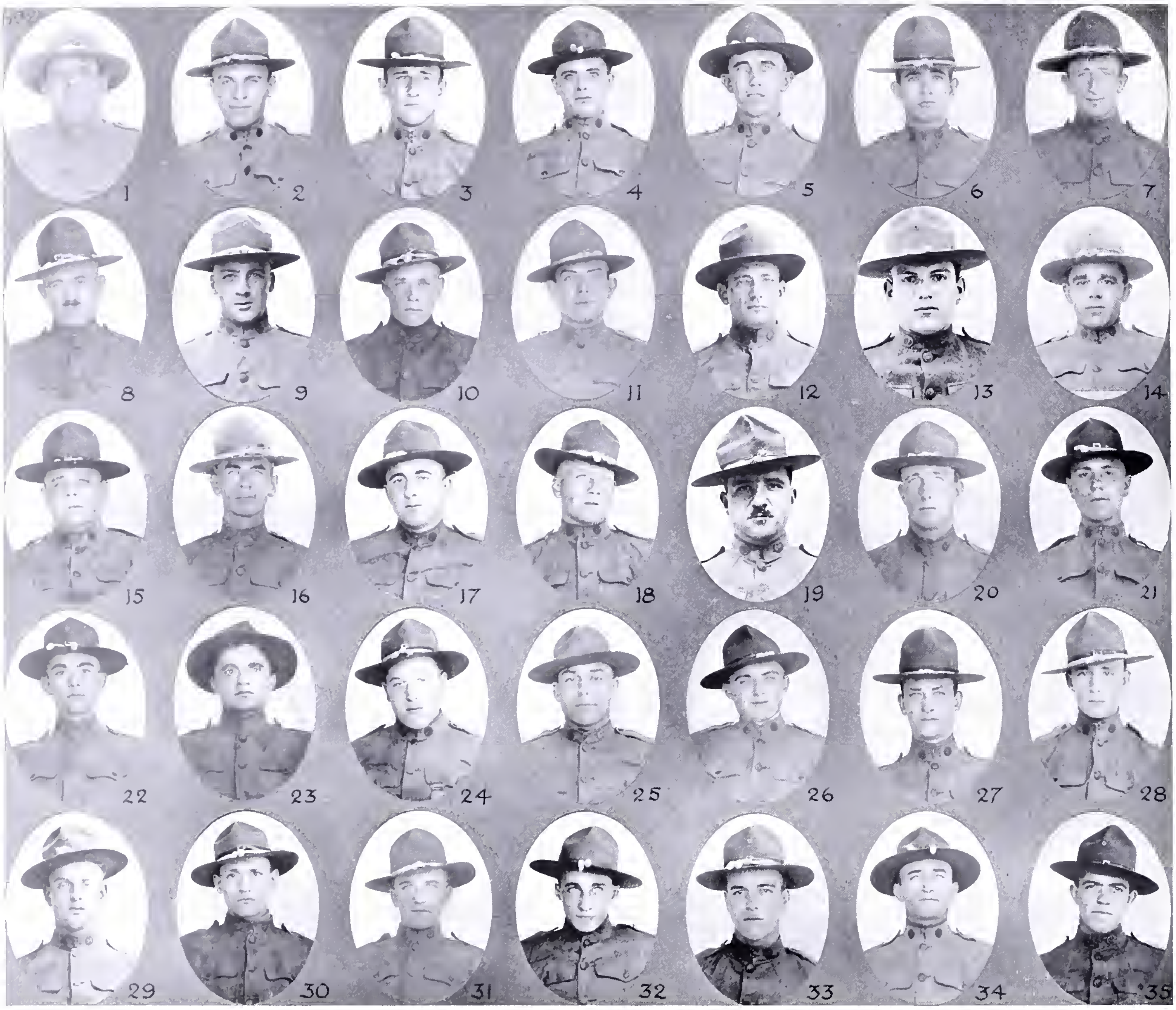
1.	Private Walter Felton	Philadelphia
2	Private Leon F. Foster	Philadelphia
3.	Private John F. Gallagher	Morea Pa.
4.	Private Clarence Gardner	Philadelphia
5.	Private John C. Grejber	Philadelphia
6.	Private Samuel Glenn	Philadelphia
7.	Private J. Goldenberg	Philadelphia
8.	Private John C. Graff	Philadelphia
9.	Private William J. Griffith	Philadelphia
10.	Private Oscar Hartman	Philadelphia
11.	Private Charles B. Heeney	New Boston, Pa.
12.	Private Eugene L. Holmes	Philadelphia
13.	Private Thomas H. Holroyd	Philadelphia
14.	Private Thomas H. Howells	Philadelphia
15.	Private John J. Jungfleish	Philadelphia
16.	Private Charles W. Kalb	Philadelphia
17.	Private Stanley Kielbisinski	Philadelphia
18.	Private Frank M. Kolp	Philadelphia
19.	Private William A. Lafferty	Philadelphia
20.	Mess Sergeant Michael F. Lucey	Philadelphia
21.	Private Norman Macdonald	Philadelphia
22.	Private Raymond I. Maginnis	Philadelphia
23.	Private Kasimuras Makszus	Philadelphia
24.	Private Louis Martini	Philadelphia
25.	Private Joseph H. McGreal	Philadelphia
26.	Private Joseph B. McGinty	Philadelphia
27.	Private John A. McIllrath	Orange, N. J.
28.	Private Frank F. McMahon	Philadelphia
29.	Private John J. McManus	Philadelphia
30.	Private Harry McShane	Philadelphia
31.	Private A. A. Maye	Philadelphia
32.	Private Harry H. Menardi	Philadelphia
33.	Private Amos D. Monhollon	Philadelphia



Company B, 1st Pennsylvania Infantry

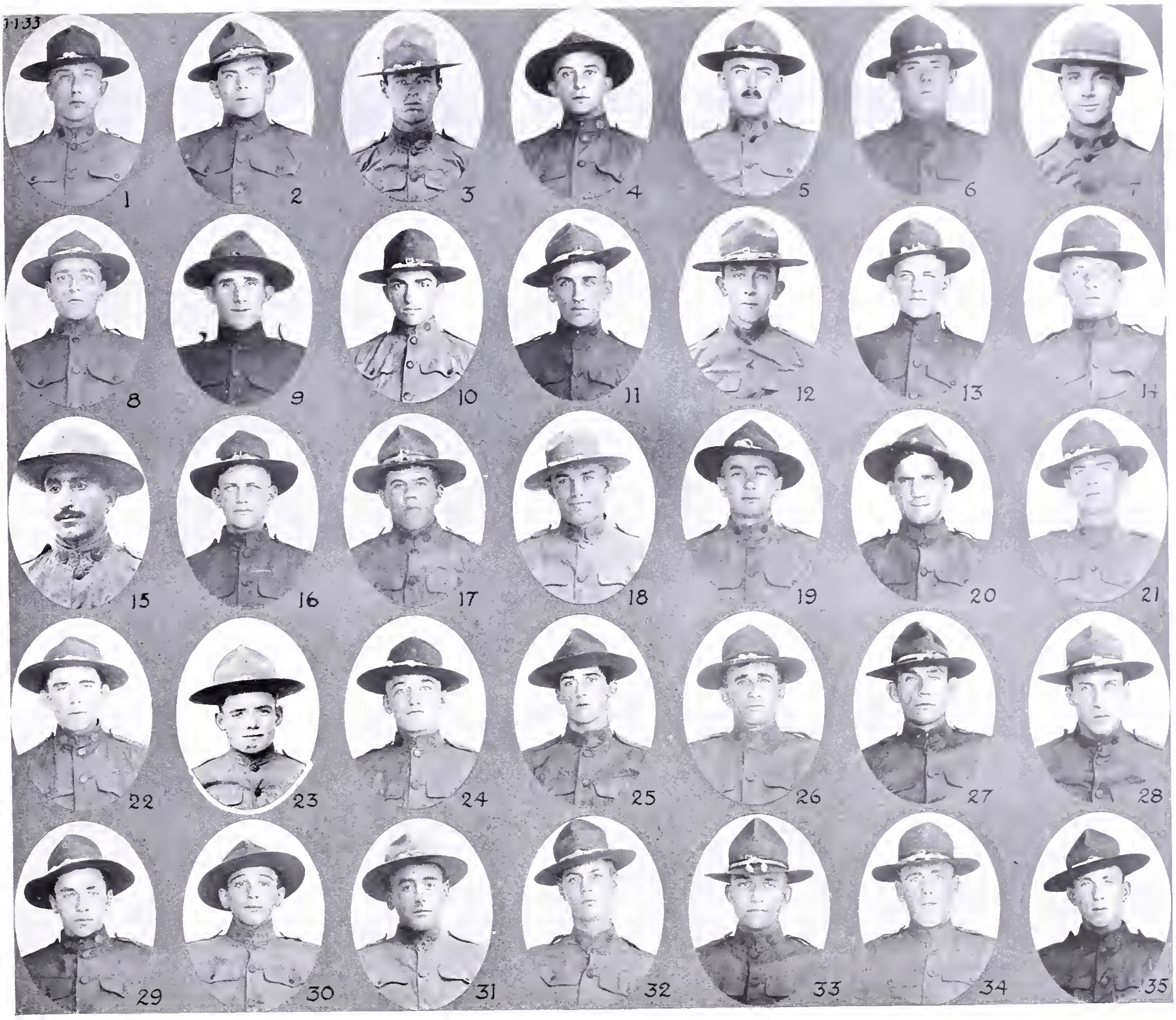
(CONTINUED)

1.	Private James D. Mulch	Philadelphia
2.	Private James Newby	Philadelphia
3.	Private Herbert Polin	Philadelphia
4.	Private Charles Pulver	Philadelphia
5.	Private Simon Rappaport	Egg Harbor, N. J.
6.	Private Charles A. Reeves	Philadelphia
7.	Private John F. Regnault	Philadelphia
8.	Private Edward T. Reynolds	Philadelphia
9.	Private Moe Robins	Philadelphia
10.	Private Michael J. Rooney	Philadelphia
11.	Private Robert Rowan	Philadelphia
12.	Private Earl W. Schalch	Holmesburg, Pa.
13.	Private Maurice M. Scharf	Philadelphia
14.	Private Joseph G. Schultz	Philadelphia
15.	Private Henry W. Sears	Philadelphia
16	Private William S. Shaffer	Philadelphia
17.	Private Henry Shaw	Philadelphia
18.	Private Walter B. Smalley	Philadelphia
19.	Private Francis Leo. Smith	Philadelphia
20.	Private Frank Smith	Philadelphia
21.	Private Joseph Smith	Philadelphia
22.	Private Warren C. Spickler	Philadelphia
23.	Private Jesse J. Stanley	Philadelphia
24.	Private Charles J. Steinbach	Philadelphia
25.	Sergeant Edward Smyth	Philadelphia
26.	Private William F. Ward	Philadelphia
27.	Private David Warner	Philadelphia
28.	Private Frank Waters	Philadelphia
29.	Private Cole Watson, Jr.	Philadelphia
30.	Private Frank Wheeler	Philadelphia
31.	Private Thomas Willard	Philadelphia
32.	Private Jos. T. Yurkinski	Philadelphia
33.	Private James R. Ziegler	Philadelphia



Company C, 1st Pennsylvania Infantry

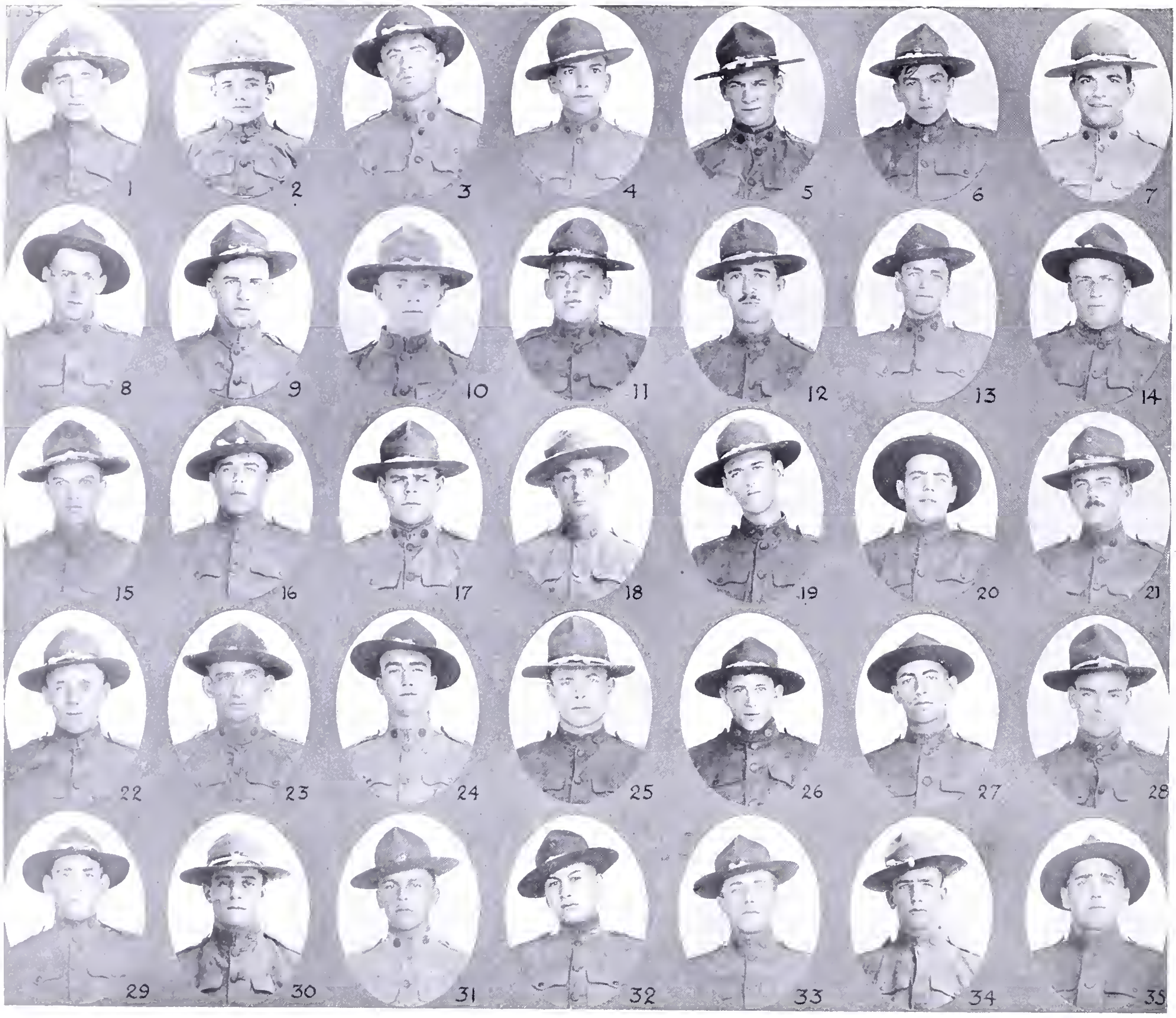
1.	Mess Sergeant C. H. Van Duyne	Philadelphia
2.	Supply Sergeant Maxwell Goldberger	Philadelphia
3.	Sergeant Jos. S. Whittington	Baltimore, Md.
4.	Sergeant E. J. Murphy	Philadelphia
5.	Sergeant J. F. Fleming	Philadelphia
6.	Sergeant E. E. Patterson, Jr.	Philadelphia
7.	Corporal C. T. Smith	Philadelphia
8.	Sergeant J. Welch	Philadelphia
9.	Corporal F. R. Moore	Philadelphia
10.	Corporal C. J. Ahern	Philadelphia
11.	Corporal A. H. Lucy	Philadelphia
12.	Corporal C. J. Hesser	Philadelphia
13.	Corporal Norman Jones	Philadelphia
14.	Cook B. Durum	Philadelphia
15.	Cook C. McCullough	Philadelphia
16.	Cook L. Wallace	Philadelphia
17.	Mechanic R. C. Lukens	Ardmore, Pa.
18.	Musician A. A. Carrigan	Philadelphia
19.	Musician L. J. Martin	Philadelphia
20.	First-class Private H. G. Boston	Philadelphia
21.	First-class Private T. A. Cassidy	Philadelphia
22.	First-class Private T. J. Glasgow	Philadelphia
23.	First-class Private H. Goodman	Philadelphia
24.	First-class Private A. Harrington	Philadelphia
25.	First-class Private B. Henderson	Philadelphia
26.	First-class Private C. H. Jeary	Philadelphia
27.	First-class Private G. McLaughlin	Philadelphia
28.	First-class Private J. M. Mellon	Philadelphia
29.	Private Thomas G. Aickin	Philadelphia
30.	Private Frank G. Bale	Philadelphia
31.	Private J. J. Barry	Philadelphia
32.	Private C. A. Beers	Philadelphia
33.	Private F. G. Benjamin	Philadelphia
34.	Private L. S. Boettner	Philadelphia
35.	Private C. F. Book	Lancaster, Pa.



Company C, 1st Pennsylvania Infantry

(CONTINUED)

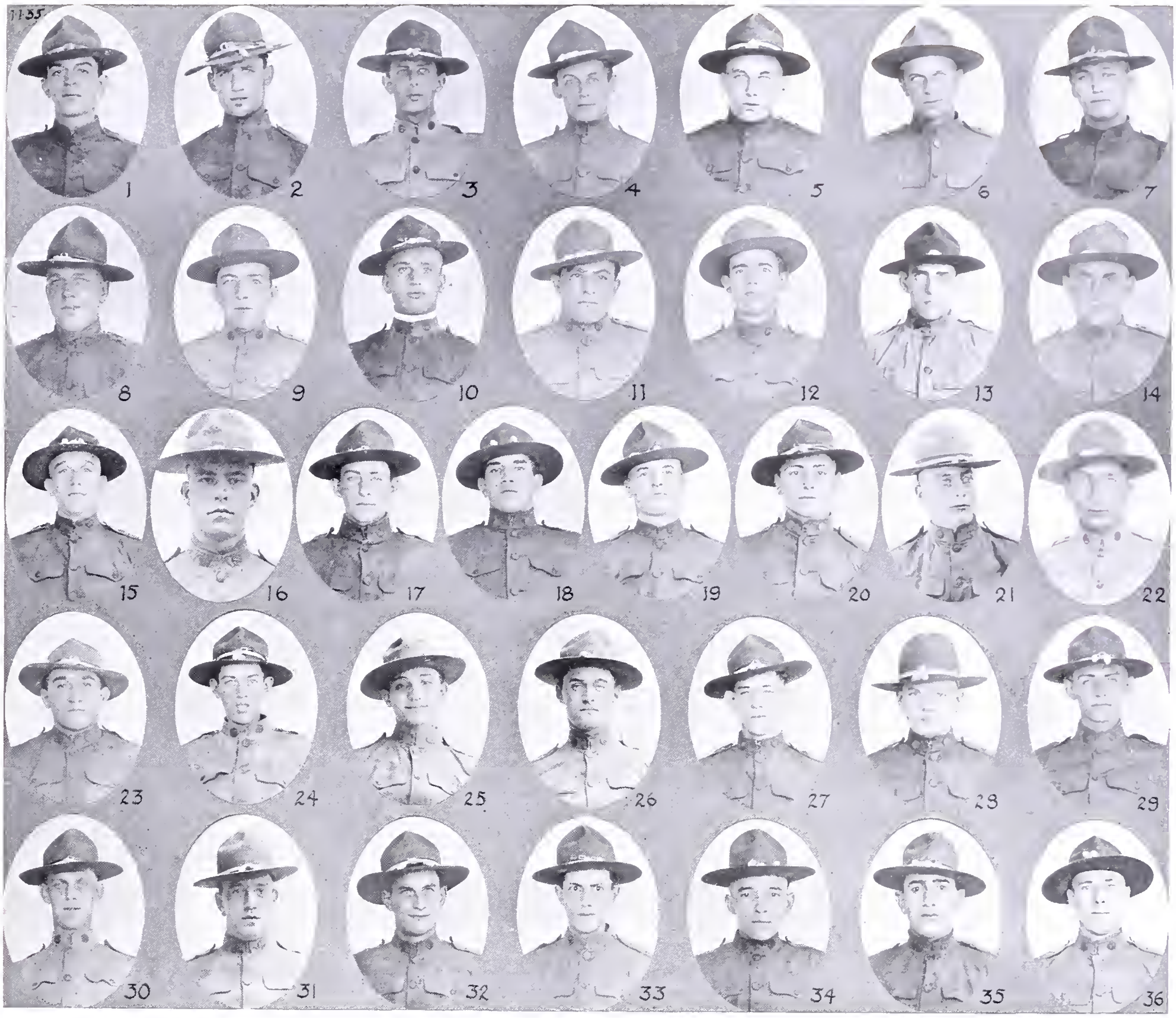
1.	Private R. V. Boyd	Philadelphia
2.	Private J. J. Brooke	Philadelphia
3.	Private R. J. Brown	Philadelphia
4.	Private Stephen A. Buck	Philadelphia
5.	First-class Private J. Chesterman	Philadelphia
6.	First-class Private E. J. Clarke	Philadelphia
7.	Private David H. Cochran	Philadelphia
8.	Private J. A. Coll	Philadelphia
9.	Private F. R. Collins	Philadelphia
10.	Private H. Coraluzzi	Philadelphia
11.	Private H. J. Cotton	Philadelphia
12.	Cook J. F. Daly	Philadelphia
13.	Private G. K. Daugherty	Philadelphia
14.	Sergeant W. Davison	Philadelphia
15.	Private Rocco Dottoli	Philadelphia
16.	Private L. C. Daugherty	Philadelphia
17.	Private J. C. Downs	Philadelphia
18.	Private W. Doyle	Colwyn, Pa.
19.	Private J. S. Drake	Olney, Pa.
20.	Private A. J. J. Drew	Philadelphia
21.	Private W. Dunning	Philadelphia
22.	Private F. A. Dunsmore	Philadelphia
23.	Private J. P. Green	Philadelphia
24.	Private J. F. Egan	Philadelphia
25.	Private E H. Ervien	Philadelphia
26.	Private W. Fisher	Roxborough, Pa.
27.	Private B. H. Fischer	Tacony, Pa.
28.	Private A. M. Fleshman	Philadelphia
29.	Private J. F. Ford	Philadelphia
30.	Private I. Forman	Philadelphia
31.	Private G. A. Foy	Philadelphia
32.	Private F. B. Franklin, Jr.	Noble, Pa.
33.	First-class Private J. P. Fullerton, Jr	Philadelphia
34.	Private F. J. Gallagher	Philadelphia
35.	Private V. B. Gibson	Philadelphia



Company C, 1st Pennsylvania Infantry

(CONTINUED)

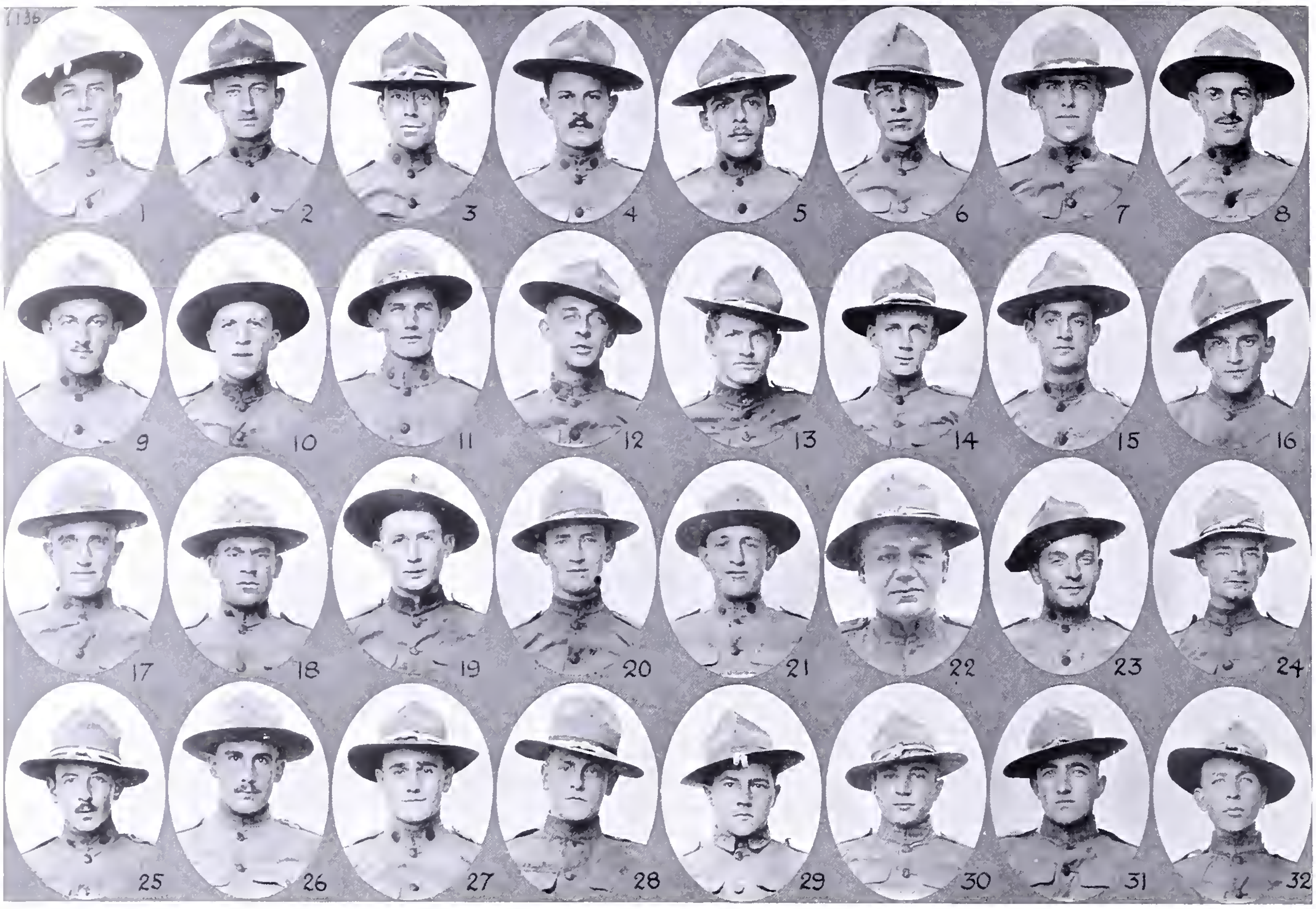
1.	Private N. Glassman	Philadelphia
2.	Private J. Green	Philadelphia
3.	Private H. Haley	Philadelphia
4.	Private C. A. Healis	Philadelphia
5.	Private H. S. Hetherington	Philadelphia
6.	Private G. H. Hocke	Philadelphia
7.	Private W. M. Imhof	Philadelphia
8.	Private E Jenks, Jr.	Philadelphia
9.	Private H. A. Jenks	Philadelphia
10.	Private Al Kane	Philadelphia
11.	Private C. A. Kerr	Philadelphia
12.	Private W. King	Philadelphia
13.	Private G. Koch	Philadelphia
14.	Private F. L. Langdon	Philadelphia
15.	Private J. T. McCloskey	Philadelphia
16.	Private Daniel McCloud	Philadelphia
17.	Private J. McCool	Philadelphia
18.	Private G. P. McGinley	Philadelphia
19.	Private T. J. McGovern	Philadelphia
20.	Private J. J. McGuigan	Philadelphia
21.	Private C. A. McLean	Philadelphia
22.	Private William McMenamin.	Philadelphia
23.	Private R. McMinn	Philadelphia
24.	Private R. McNamee	Philadelphia
25.	Private W. A. McQuade	Philadelphia
26.	Private W. McQuaid	Philadelphia
27.	Private Conrad J. Maag	Philadelphia
28.	Private J. H. Mack	Philadelphia
29.	Private W. J Meyers	Philadelphia
30.	Private J. W. Mitchell	Philadelphia
31.	Private L. B. Moore	Philadelphia
32.	Private J. F. Newman	Philadelphia
33.	Private W. L. Nool	Philadelphia
34.	Private B. P. O'Connel	Philadelphia
35.	Private Michael Patrick	Phoenixville, Pa.



Company C, 1st Pennsylvania Infantry

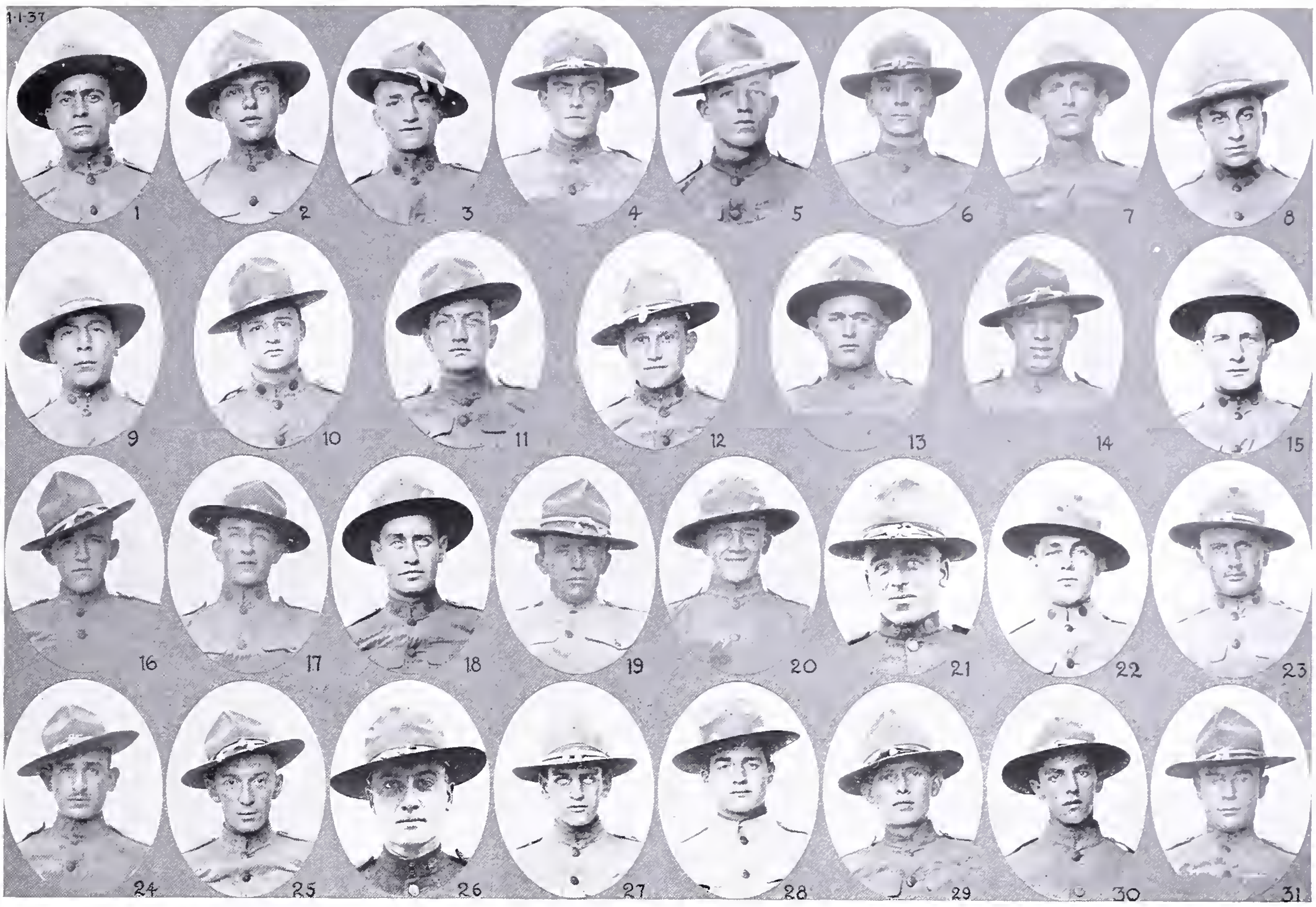
(CONTINUED)

1.	Private W. F. Ranson	Philadelphia
2.	Private M. R. Roehm	Philadelphia
3.	Private R. Roshon	Philadelphia
4.	Private O. H. Rost, Jr.	Philadelphia
5.	Private W. A. Rzepski	Philadelphia
6.	Private W. A. Sneff	Philadelphia
7.	Private A. W. Sheppard	Philadelphia
8.	Private R. Shoemaker	Philadelphia
9.	Private F. Sickinger	Philadelphia
10.	Private M. Silnutzer	Philadelphia
11.	Private A. J. Sivo	Philadelphia
12.	Private J. Smith	Philadelphia
13.	Private E. J. Sparks	Philadelphia
14.	Private J. R. Stokes, Jr.	Lansdowne, Pa.
15.	Private F. S. Steinman	Philadelphia
16.	Private G. H. Stone	Philadelphia
17.	Private F. R. Strough	Philadelphia
18.	Private F. J. Tagmire	Philadelphia
19.	Private R. H. Thorpe	Philadelphia
20.	Private J. A. Thomas	Philadelphia
21.	Private James Trend, Jr.	Cynwyd, Pa.
22.	Private C. F. Uschmann	Philadelphia
23.	Private Joseph Valentine	Philadelphia
24.	Private C. C. Van Kirk	Philadelphia
25.	Private D. Wagner	Philadelphia
26.	Private T. A. Waters	Philadelphia
27.	Private J. T. Whitehead	Philadelphia
28.	Private F. McA. Wallace	Philadelphia
29.	Private A. B. Wilson	Philadelphia
30.	Private J. Wood	Philadelphia
31.	Private J. W. Worster	Philadelphia
32.	Private A. W. Zeller	Philadelphia
33.	Private J. A. Zeller	Philadelphia
34.	Private F. J. Lynch, Jr.	Philadelphia
35.	Private J. F. Deere	Drexel Hill, Pa.
36.	Private Philip Renninger	Glenside, Pa.



Company D, 1st Pennsylvania Infantry

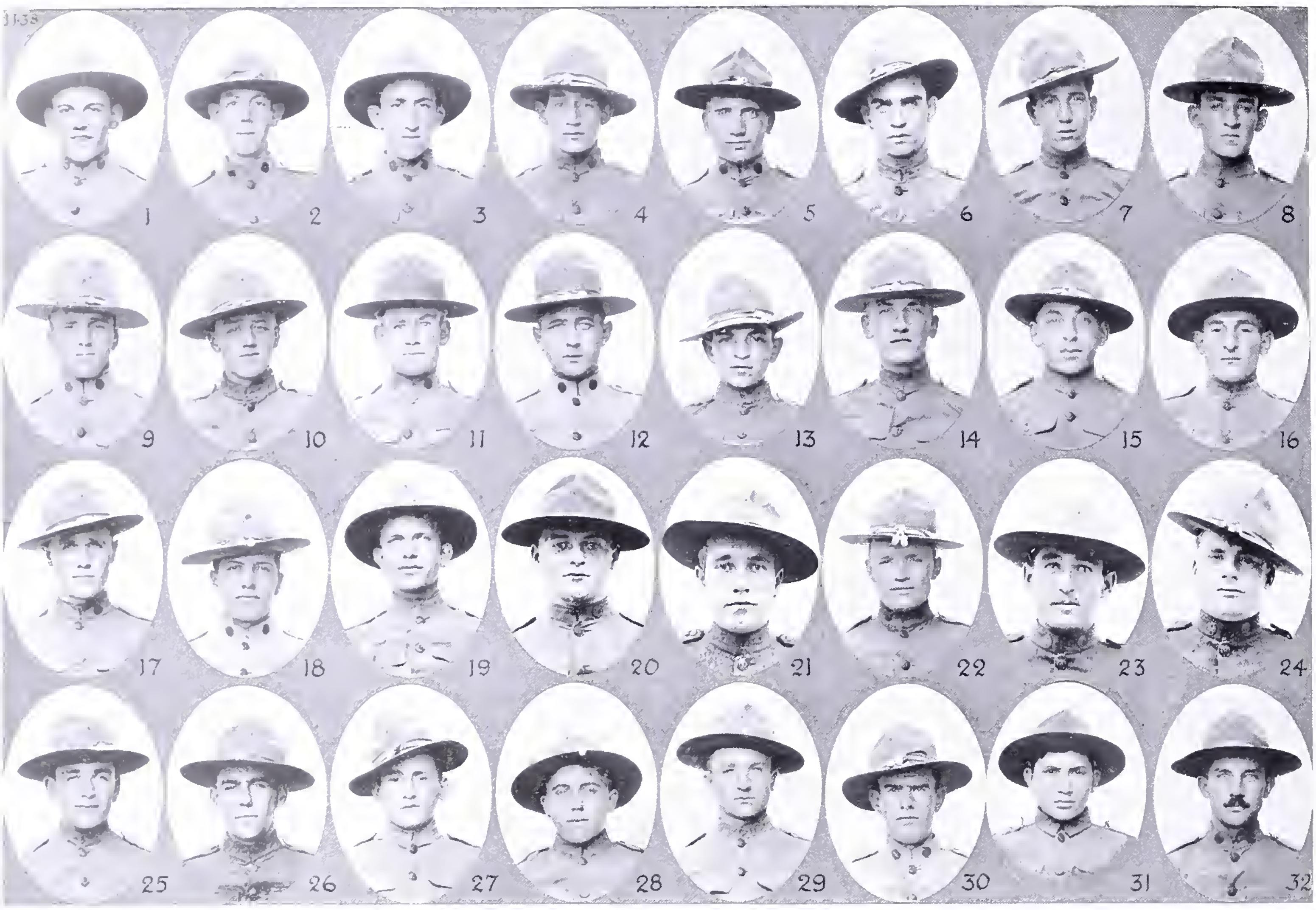
1.	First Sergeant Howard G. Daniels	Philadelphia
2.	Supply Sergeant Edward H. Flynn	Philadelphia
3.	Mess Sergeant Charles E. Booth	Philadelphia
4.	Sergeant William H. Davis, Jr.	Philadelphia
5.	Sergeant Myer R. Barrett	Philadelphia
6.	Sergeant William T. Leonard	Philadelphia
7.	Sergeant James E. Hillard	Philadelphia
8.	Sergeant Daniel F. Goettel	Philadelphia
9.	Sergeant Guyon J. Weirman	Arrendsville, Pa.
10.	Corporal Francis X. Myers	Philadelphia
11.	Corporal Edward Hack	Philadelphia
12.	Corporal Jacob Y. Eberly	Philadelphia
13	Corporal Horace G. Atchison	Philadelphia
14.	Bugler Raymond A. Clausz	Philadelphia
15.	Bugler Martin A. Cleary	Philadelphia
16.	First-class Private William F. Bauer	Philadelphia
17.	First-class Private Gordon L. Bisbing	Philadelphia
18.	First-class Private John G. Booth	Philadelphia
19.	First-class Private Joseph T. Conway	Peoples, Pa.
20.	First-class Private Joseph F. Dalton	Philadelphia
21.	First-class Private Jacob J. Dautel	Philadelphia
22.	First-class Private Roland E. Driver	Philadelphia
23.	First-class Private Joseph M. Feger	Philadelphia
24.	First-class Private John T. Green	Philadelphia
25.	First-class Private Harry T. Lippincott	Philadelphia
26.	First-class Private George W. Meell	Philadelphia
27.	First-class Private Charles L. Parke	Philadelphia
28.	First-class Private Irving H. Stearly	Philadelphia
29.	First-class Private Harry A. Tressel	Philadelphia
30.	First-class Private Frederick R. Weber	Philadelphia
31.	Private Ralph J. Afflerbach	Philadelphia
32.	Private Andrew Atchinson	Philadelphia



Company D, 1st Pennsylvania Infantry

(CONTINUED)

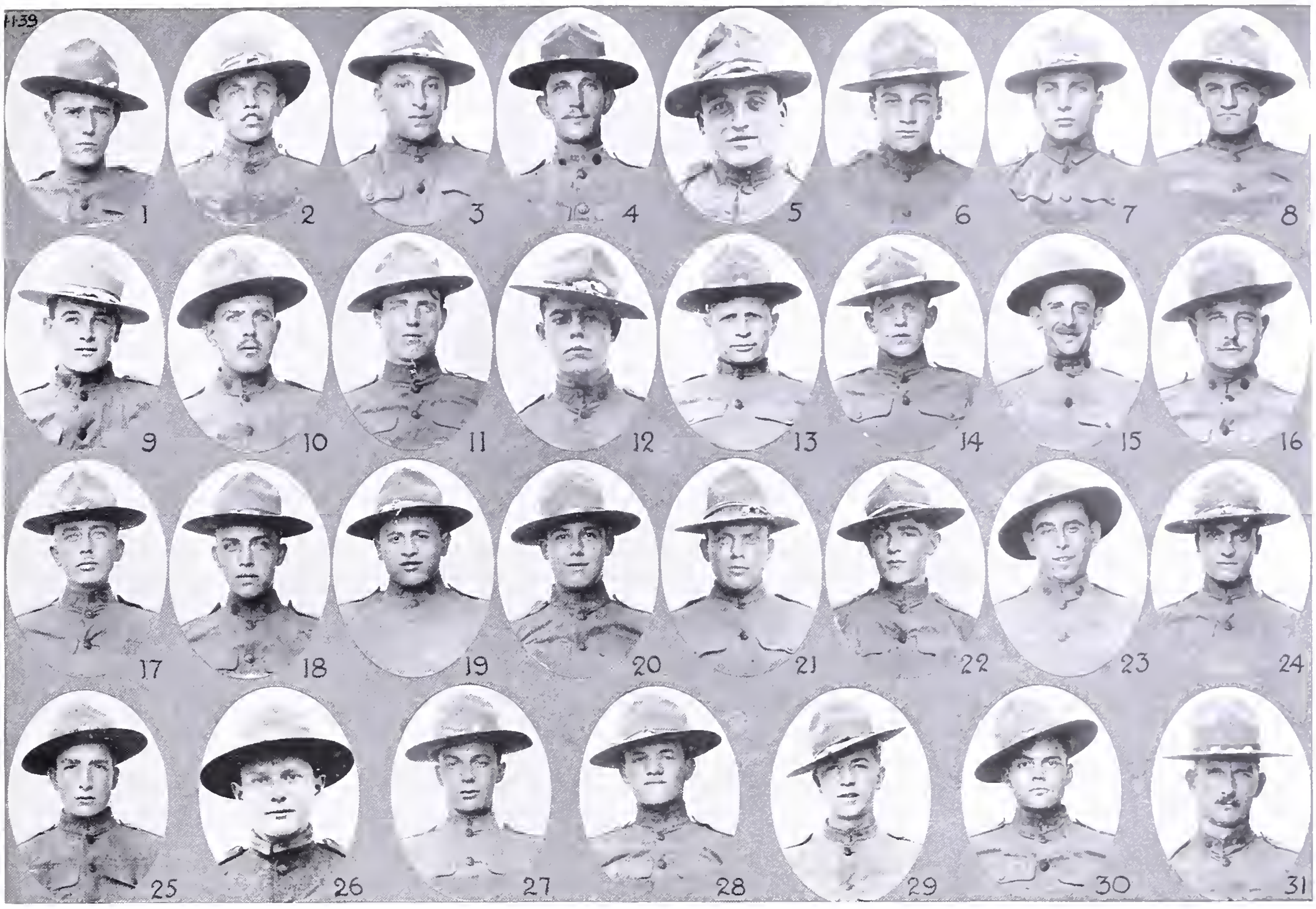
1.	Private Thomas E. Bailey	Philadelphia
2.	Private William J. W. Becker	Philadelphia
3.	Private Edward T. Brannagan	Philadelphia
4.	Private Hugh F. Brogan	Philadelphia
5.	Private Victor G. Brobst	Philadelphia
6.	Private John N. S. Burke	Philadelphia
7.	Private Hugh J. Callahan	Chester, Pa.
8.	Private James A. Cameron	Philadelphia
9.	Private Phillip Canello	Philadelphia
10.	Private Ewing Clarke	Philadelphia
11.	Private John J. Clark	Philadelphia
12.	Private Thomas Cleaver	Philadelphia
13.	Private Joseph T. Coates	Philadelphia
14.	Private Michael J. Connor	Philadelphia
15.	Private Thomas J. Creary	Philadelphia
16.	Private Edward Cunningham	Philadelphia
17.	Private John G. Davis	Philadelphia
18.	Private Charles H. Dearlove	Philadelphia
19.	Private Warren J. Decker	Philadelphia
20.	Private Daniel Dougherty	Philadelphia
21.	Private John J. Doyle	Philadelphia
22.	Private Jos. T. Doyle	Philadelphia
23.	Private Anthony M. Etzel	Philadelphia
24.	Private Jack H. Fisher	Philadelphia
25.	Private Francis S. Fehn	Newportville, Pa.
26.	Private Raymond L. Fiedler	Philadelphia
27.	Private Oscar T. Fleisher	Philadelphia
28.	Private John T. Foley	Philadelphia
29.	Private George J. Ford	Philadelphia
30.	Private Joseph A. Franz	Philadelphia
31	Private Louis J. Gallagher	Philadelphia



Company D, 1st Pennsylvania Infantry

(CONTINUED)

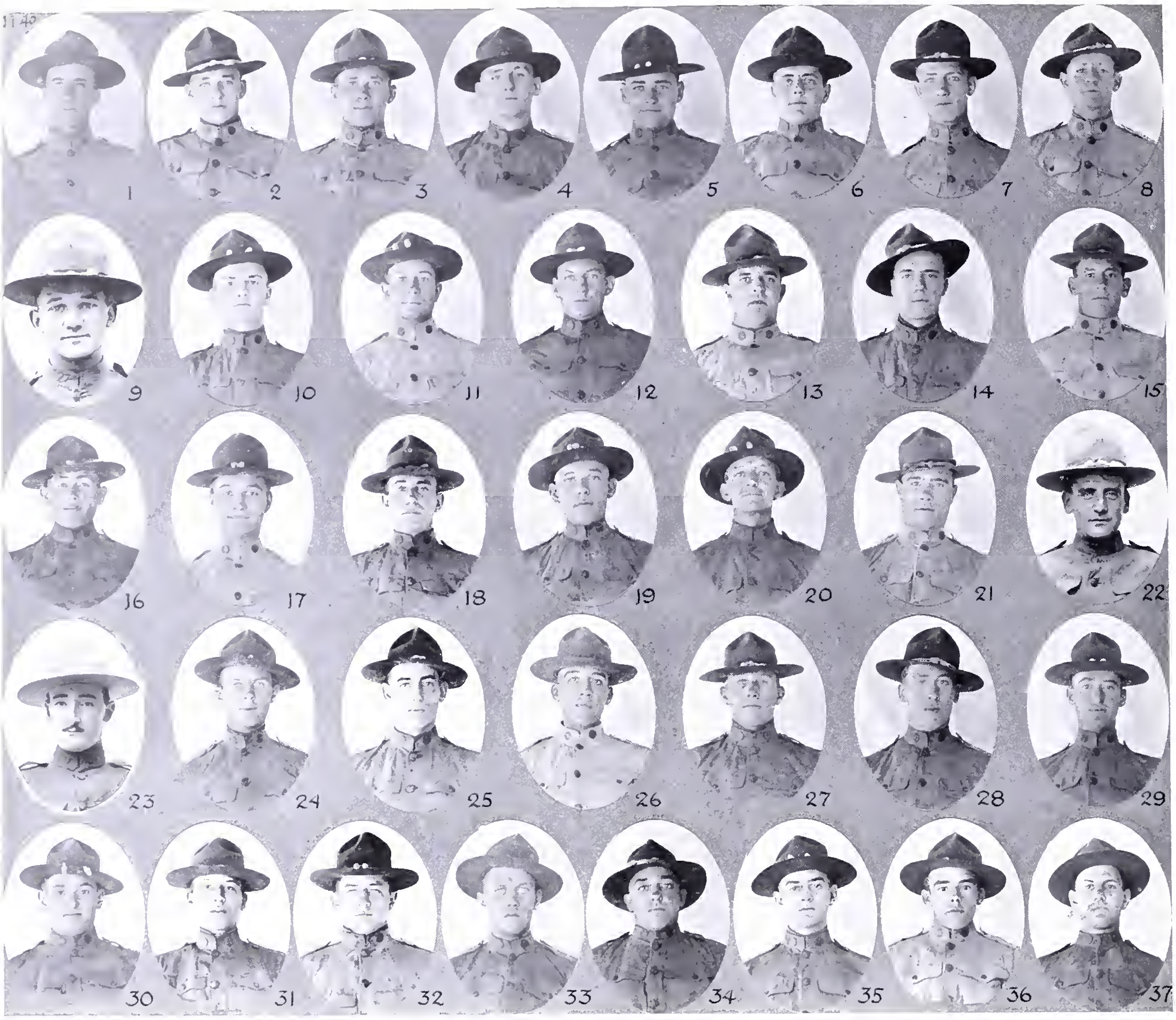
1.	Private William J. Gallagher	Philadelphia
2.	Private William W. Grover	Philadelphia
3.	Private Richard Hackford	Philadelphia
4.	Private Norman I. Harris	Philadelphia
5.	Private Walter J. Hause	Philadelphia
6.	Private William H. Holst	Philadelphia
7.	Private Frank S. Honer	Philadelphia
8.	Private Bradford Hutchinson	Philadelphia
9.	Private Harry V. Jacoby	Philadelphia
10.	Private Howard B. Jardine	Berwyn, Pa.
11.	Private John Kenney	Philadelphia
12.	Private Leon R. Kirschke	Philadelphia
13.	Private Louis Klein	Philadelphia
14.	Private William F. Knoll	Philadelphia
15.	Private Nathan Kurtz	Philadelphia
16.	Private William Kirschner	Philadelphia
17.	Private John F. Locke	Shamrock, Texas
18.	Private Albert Magnin	Philadelphia
19.	Private Edward Morosky	Philadelphia
20.	Private William C. Morton	Philadelphia
21.	Private Dempster R. Murphy	Philadelphia
22.	Private John J. McCann	Philadelphia
23.	Private Wm. F. McCloskey	Philadelphia
24.	Private Walter J. McDonald	Philadelphia
25.	Private Bernard J. McGlone	Philadelphia
26.	Private Thomas McKale	Philadelphia
27.	Private Edward McIlvaine	Philadelphia
28.	Private Charles Oetzel	Philadelphia
29.	Private Vincent F. O'Hanlon	Philadelphia
30.	Private Joseph A. Palmer	Philadelphia
31.	Private Phillip Pastore	Philadelphia
32.	Private James H. Patten	Philadelphia



Company D, 1st Pennsylvania Infantry

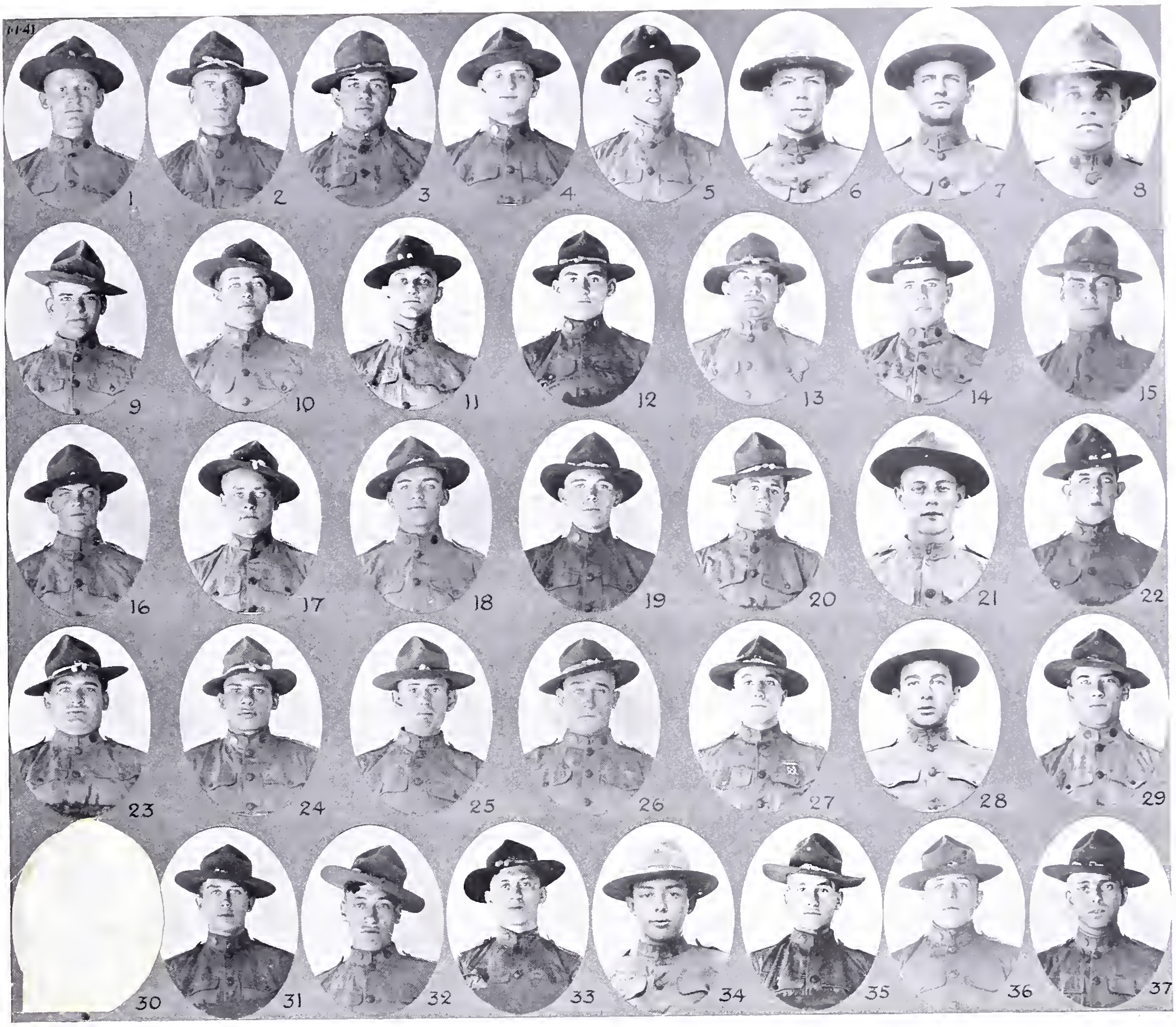
(CONTINUED)

1.	Private James C. Peak	Philadelphia
2.	Private Frederick Peterson	Philadelphia
3.	Private Charles G. Pflugfelder	Philadelphia
4.	Private William Pinkham	Philadelphia
5.	Private Gus Piscitelli	Philadelphia
6.	Private Joseph N. Piscitelli	Philadelphia
7.	Private Joseph Polidoro	Philadelphia
8.	Private Louis M. Resse	Philadelphia
9.	Private Claude R. Robertson	Philadelphia
10.	Private Emil B. Roessling	Philadelphia
11.	Private Frederick W. Schaub	Philadelphia
12.	Private John Schwoer	Philadelphia
13.	Private Winifield Scott	Auburn, Pa.
14.	Private George H. Sheehan	Philadelphia
15.	Private Frederick Simpson, Jr.	Philadelphia
16.	Private James McG. Shearer	Philadelphia
17.	Private George B. Smith	Philadelphia
18.	Private William C. Smith	Philadelphia
19.	Private Joseph F. Spear	Philadelphia
20.	Private Frank E. Stein	Philadelphia
21.	Private Harry H. Stroup	Philadelphia
22.	Private Walter F. Thomas	Berwyn, Pa.
23.	Private William Trainor	Philadelphia
24.	Private George Tucci	Philadelphia
25.	Private John R. Turns	Louisville, Ky.
26.	Private Fred Wagner	Philadelphia
27.	Private Lawrence Wilson	Philadelphia
28.	Private John F. Walsh	Philadelphia
29.	Private Woodruff Warren	Philadelphia
30.	Private William J. White	Philadelphia
31.	Private John Winton	Philadelphia



Company E, 1st Pennsylvania Infantry

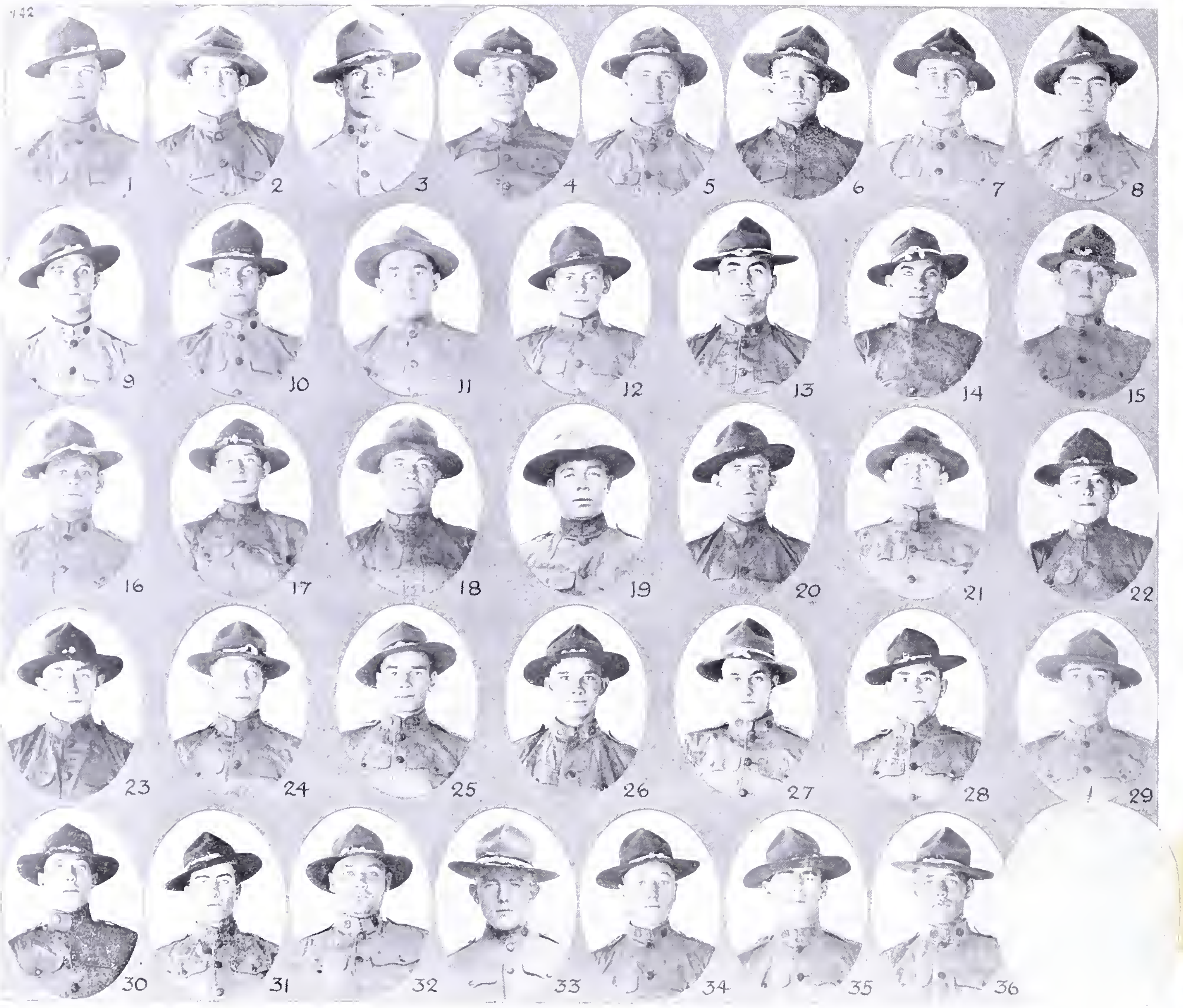
1.	First Sergeant George C. Rippel	Milton, Pa.
2.	Supply Sergeant Aloysius F. Morthorst	Philadelphia
3.	Mess Sergeant Thomas P. Donahue	Philadelphia
4.	Sergeant Charles L. Devaney	Philadelphia
5.	Sergeant James N. Parker	Philadelphia
6.	Sergeant William T. Gammons	Philadelphia
7.	Sergeant Emil H. Ruppel	Philadelphia
8.	Sergeant Thomas H. Brown	Philadelphia
9.	Sergeant John H. Todd	Camden, N. J.
10.	Corporal John R. Killian	Philadelphia
11.	Sergeant George N. Thorpe	Philadelphia
12.	Corporal Mark C. Buckley	Steelton, Pa.
13.	Corporal Frank Miller	Philadelphia
14.	Corporal Frank J. Percy	Philadelphia
15.	Private John Risdon	Philadelphia
16.	Corporal Maynard C. Smith	Philadelphia
17.	Corporal Raymond U. Mueeler	Philadelphia
18.	Cook Frank Mason	Philadelphia
19.	Cook William E. Poore	Viola, Dela.
20.	Mechanic Charles C. Anderson	Philadelphia
21.	Mechanic John McGinley	Philadelphia
22.	Private W. D. Davis	Philadelphia
23.	Sergeant Wm. C. Ross	Philadelphia
24.	Corporal Edward Gaffney	Philadelphia
25.	First-class Private George S. Green	Philadelphia
26.	Corporal William J. Harvison	Philadelphia
27.	First-class Private Frederick Lauer	Philadelphia
28.	First-class Private James S. McMair	Wilkinsburg, Pa.
29.	Corporal John P. McMahon	Philadelphia
30.	First-class Private Morris H. Mann	Philadelphia
31.	First-class Private Joseph H. Rose	Philadelphia
32.	First-class Private Edward K. Seeds	Philadelphia
33.	First-class Private Chas. F. Sharpless, Jr.	Philadelphia
34.	First-class Private John J. Shedaker	Philadelphia
35.	First-class Private Ralph T. Shoemaker	Philadelphia
36.	Corporal Howard Swift	Philadelphia
37.	First-class Private William A. Wagner	Philadelphia



Company E, 1st Pennsylvania Infantry

(CONTINUED)

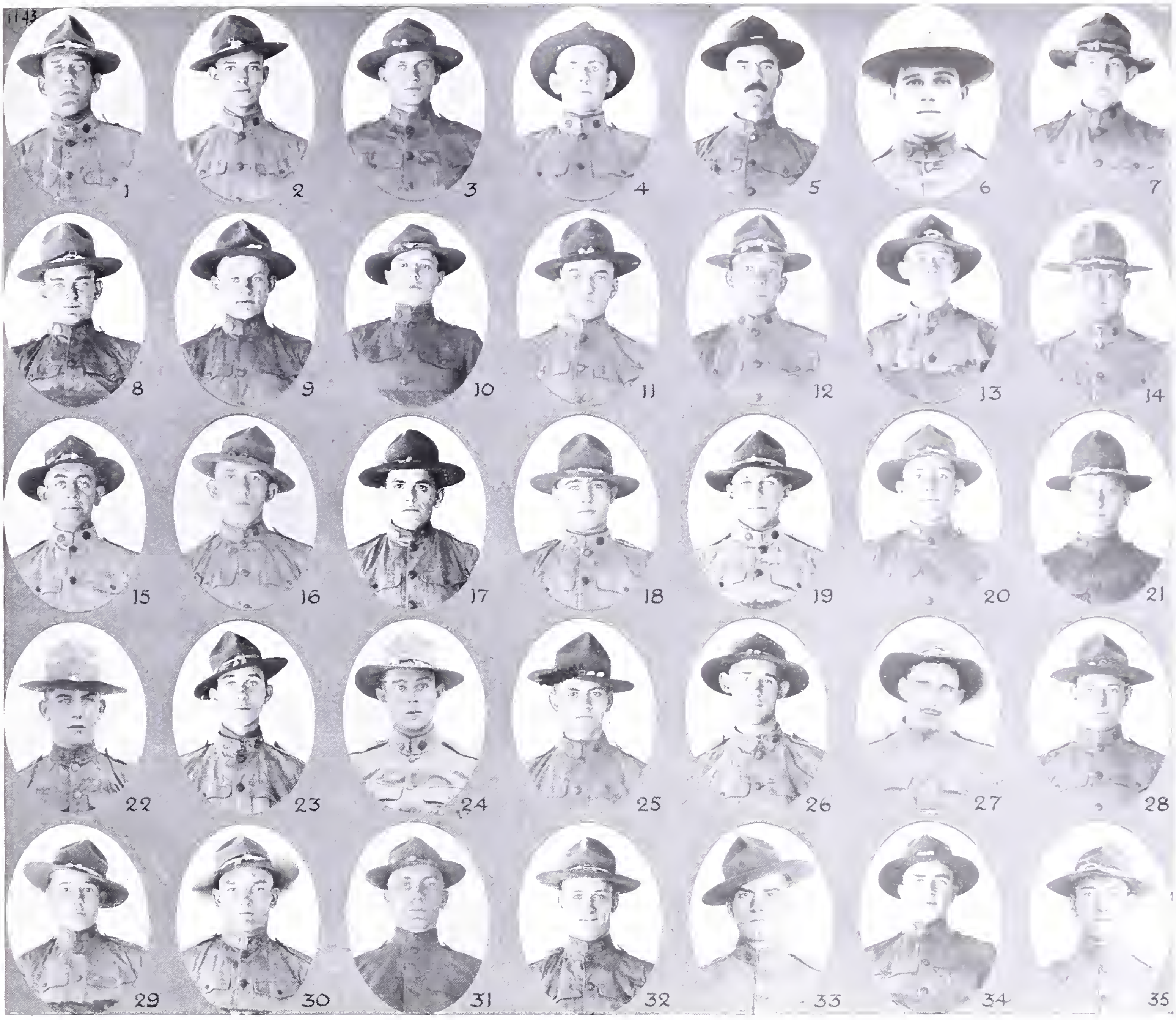
1.	Corporal William C. Zimmer	Philadelphia
2.	Private Edward B. Allen	Philadelphia
3.	Bugler Charles W. Austin	Philadelphia
4.	First-class Private Bernard C. Baer	Philadelphia
5.	Private William F. Barrett	Philadelphia
6.	Private Ignatius J. Bail	Upland, Pa.
7.	Private Walter Beck	Chester, Pa.
8.	Private Victor Bennett	Philadelphia
9.	Private Conlin C. Bickford	Philadelphia
10.	Private Michael Boyko	Philadelphia
11.	Private Joseph Bradberry	Philadelphia
12.	Private James A. Breen	Linwood Heights, Pa.
13.	First-class Private Charles L. Brown	Philadelphia
14.	Private J. E. Burke	Philadelphia
15.	Private William J. Callahan	Philadelphia
16.	Private Thomas B. Candler	Philadelphia
17.	Private Robert W. Carlin	Philadelphia
18.	Private [illegible]	[illegible]
19.	Private John J. [illegible]	[illegible]
20.	Private John W. Conlin	Philadelphia
21.	Private Frank Connolly	Philadelphia
22.	Private Roy Cramer	Philadelphia
23.	Private William Cwalina	Mt. Holly, N. J.
24.	Private Harry DeYoung	Philadelphia
25.	Private James E. Doherty	Philadelphia
25.	Private William F. Dorman	Philadelphia
27.	Private P. R. Dorn	Philadelphia
28.	Corporal Nicholas L. Dragonette	Philadelphia
29.	Private Frank J. Dupe	Manayunk, Pa.
30.	First-class Private William J. Ewing	Philadelphia
31.	First-class Private Frank D. Farra	Philadelphia
32.	Private John Fernon	Philadelphia
33.	Private Robert M. Forkish	Philadelphia
34.	Private Joseph A. Fowler	Philadelphia
35.	Private William Gambrill, Jr.	Philadelphia
36.	Private Carl J. Ganz	Philadelphia
37.	First-class Private Harry W. Geiger	Philadelphia



Company E, 1st Pennsylvania Infantry

(CONTINUED)

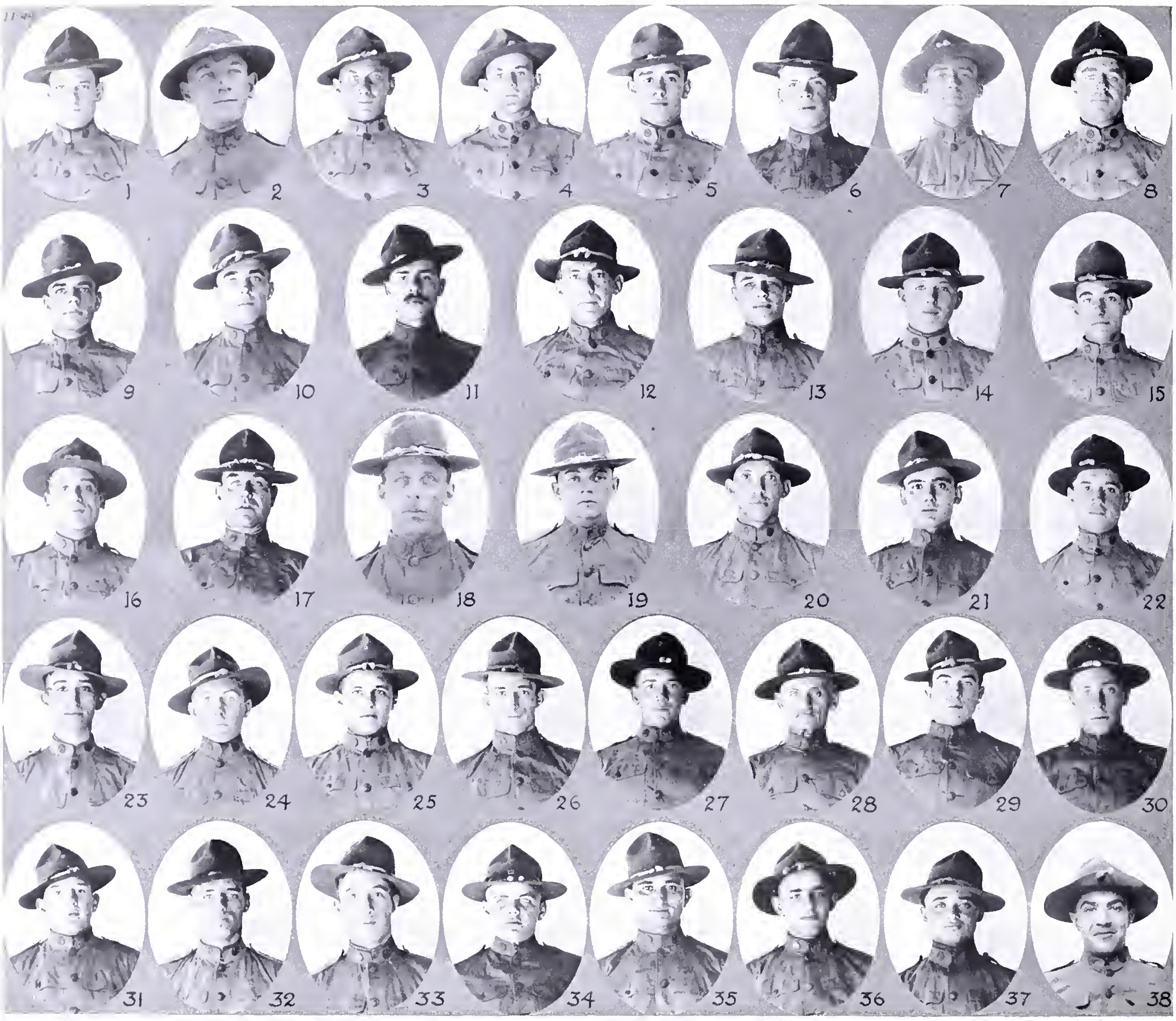
1.	First-class Private Andrew J. Gessay	Philadelphia
2.	Private Israel Goldfarb	Philadelphia
3.	Private Sidney Gordon	Philadelphia
4.	Cook Ebeneezer H. Green	Philadelphia
5.	Private George Hails	Wayne, Pa.
6.	Private Andrew J. Harkesheimer, Jr.	Philadelphia
7.	Private Alfred E. Hefner	Philadelphia
8.	Private Richard J. Helmar	Philadelphia
9.	Private Daniel A. Henninger	Philadelphia
10.	Corporal George H. Hughey	Philadelphia
11.	Private Owen B. Hunt	Philadelphia
12.	Private Patrick J. Kelly	Philadelphia
13.	Private Thomas F. Kelly	Philadelphia
14.	Private Charles Kennedy	Philadelphia
15.	Private George W. Ketterer	Philadelphia
16.	Private Elmer C. Kling	Philadelphia
17.	Private George Knable	Philadelphia
18.	Private John Koscharek	Philadelphia
19.	Private Cyril W. Lawrence	Philadelphia
20.	Private Christopher E. Levey, Jr	Philadelphia
21.	Private Wayne H. Lewis	Philadelphia
22.	Private Albert J. Liszziuniski	Philadelphia
23.	Private Albert F. Link, Jr.	Philadelphia
24.	Private John F. Link	Philadelphia
25.	Private Lorenzo A. Logan	Philadelphia
26.	Private George Loudance	Philadelphia
27.	Private Allan R. Ludwig	Philadelphia
28.	Private Thomas E. Lynch	Philadelphia
29.	Private Frank X. McBrearty	Highland Park, Pa.
30.	Private Westley McBride	Philadelphia
31.	Private Thomas McCallum, Jr.	Philadelphia
32.	Private Harry W. McCaughan	Philadelphia
33.	Private Herbert L. McClair	Philadelphia
34.	Private Elmer McCord	Philadelphia
35.	Private John P. McDevitt	Philadelphia
36	First-class Private Thomas M. McMichael	Mewtinee, Pa.



Company E, 1st Pennsylvania Infantry

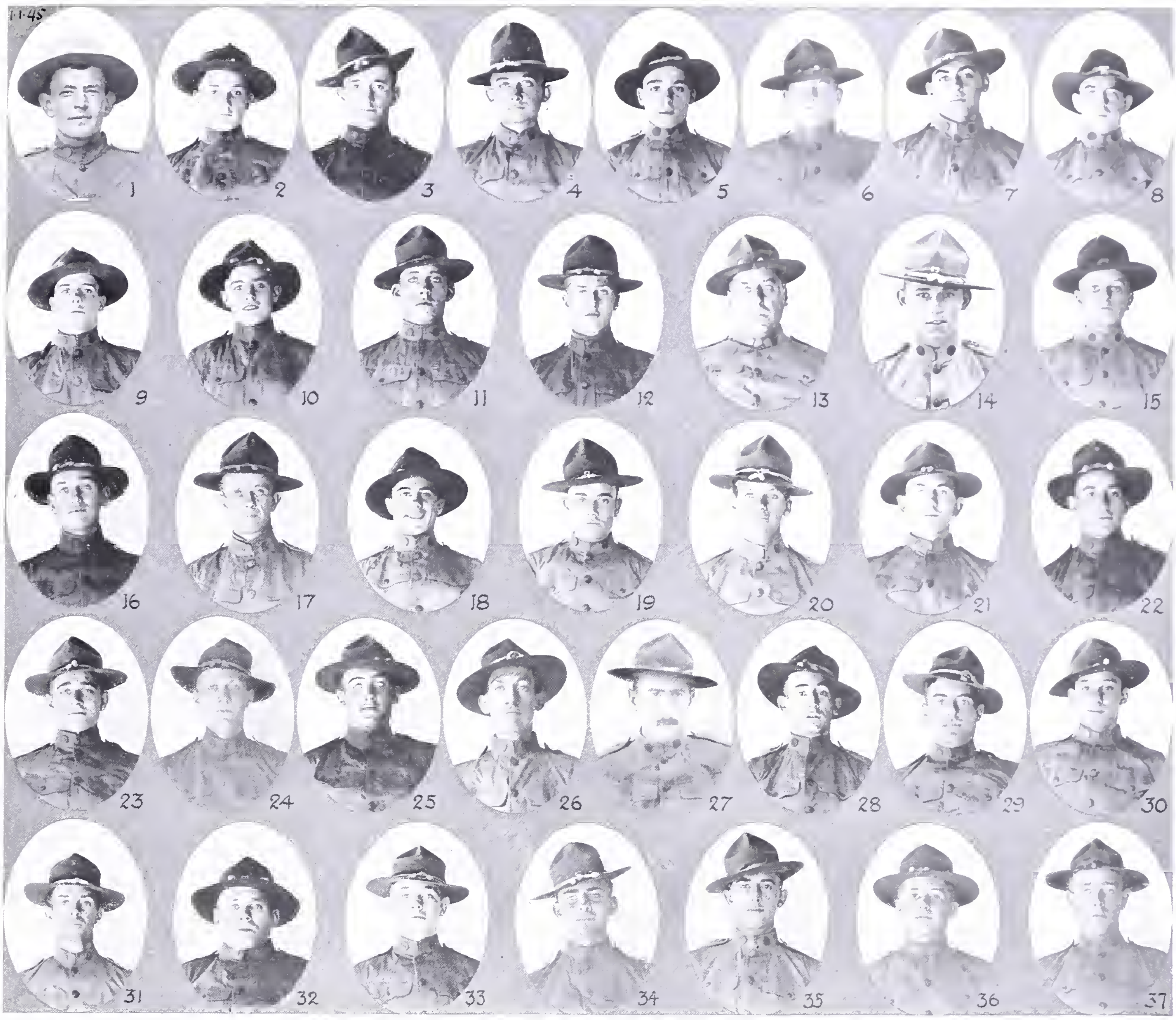
(CONTINUED)

1.	Private Cyril J. Maurer	Adrian, Mich.
2.	Private Eugene Meredith.	Philadelphia
3.	First-class Private John Mitchell	Philadelphia
4.	First-class Private John Montegue	Philadelphia
5.	Private William T. Moore	Philadelphia
6.	PrivateMichael Mullaney	Philadelphia
7.	Private Jack D. Needles	Philadelphia
8.	Private Himmers T. Parkinson	Philadelphia
9.	First-class Private Peter Pollok	Philadelphia
10.	Private Franklin B. Schauffle	Philadelphia
11.	Private William C. Schrader..	Philadelphia
12.	Private Albert F. Schultz	Philadelphia
13.	Private William E. Semmet	Philadelphia
14.	Corporal William E. Sheneman	Philadelphia
15.	Private Joseph W. Slaugh	Philadelphia
16.	Private Edgar Smith	Philadelphia
17.	Private Edward J. Smith	Philadelphia
18.	Private Harold Smith	Philadelphia
19.	Private William E. Spahr	Philadelphia
20.	Private Walter W. Spotts	Philadelphia
21.	First-class Private William Sturma, Jr.	Philadelphia
22.	Private Park Taylor	Philadelphia
23.	Private William I. Thompson	Philadelphia
24.	First-class Private Chester Trimpin.	Sag Harbor, N. Y.
25.	Private Philip B. Wagner	Philadelphia
26.	Private William J. Walls	Philadelphia
27.	Private Nelson M. White	Philadelphia
28.	Private Frank Williams	Philadelphia
29.	Private Arthur R. Worcester	Philadelphia
30.	Private Paul P. Zakaroska	Philadelphia
31.	Corporal R. Schwartz	Philadelphia
32.	Private W. E. Jones.	Philadelphia
33.	Private J. Burns.	Philadelphia
34.	Corporal J. T. Lynch	Philadelphia
35.	Private S. Murphy.	Philadelphia



Company F, 1st Pennsylvania Infantry

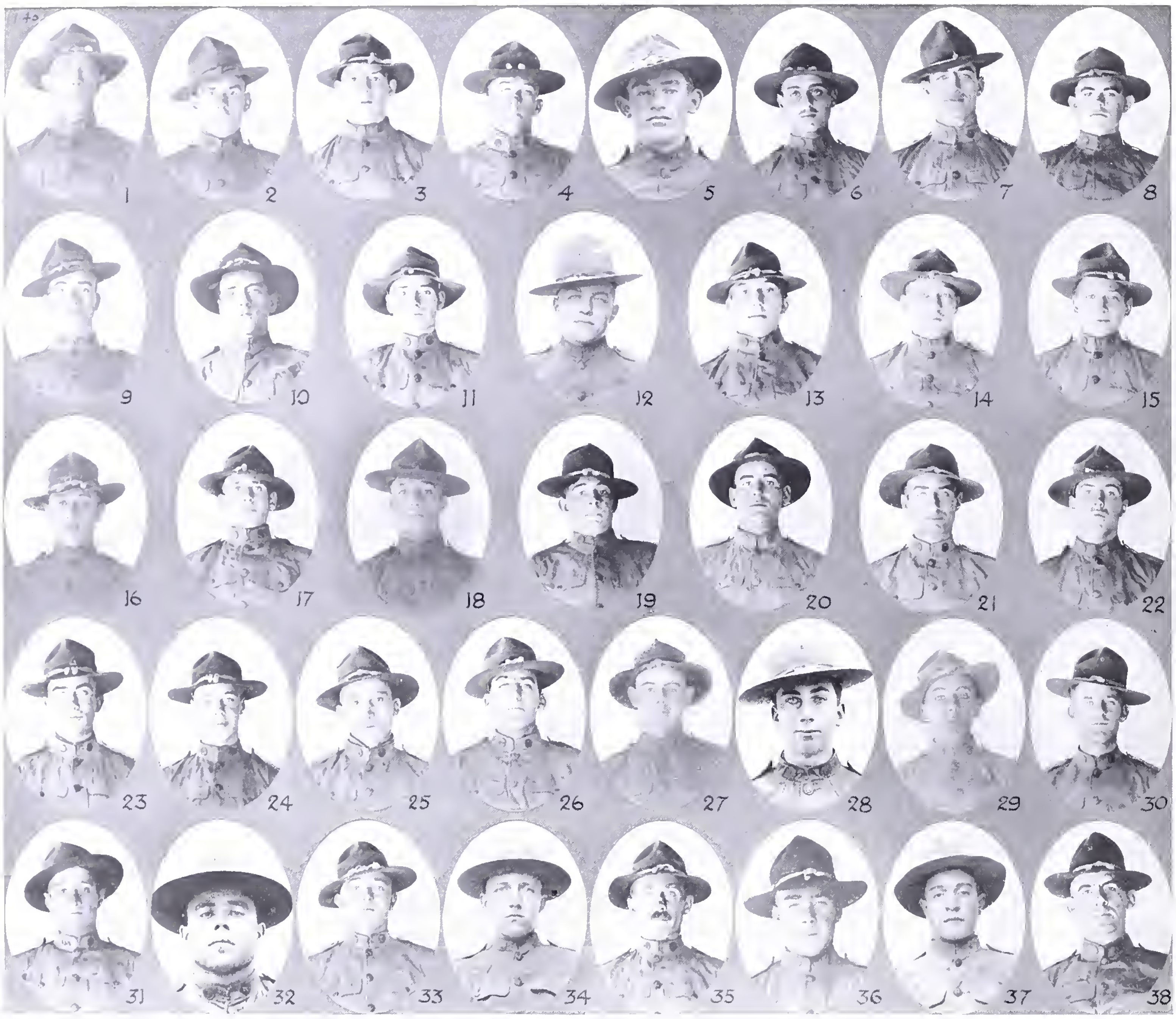
1.	Mess Sergeant George K. Myers	Philadelphia
2.	Sergeant William H. McMahon	Philadelphia
3.	Sergeant Harry S. Long	Philadelphia
4.	Sergeant Earl H. Titus	Philadelphia
5.	Sergeant Ferdinand F. Kohlmeyer	Philadelphia
6.	Sergeant Daniel P. Lafferty	Philadelphia
7.	Sergeant Harry F. Winkelspecht	McKinley, Pa.
8.	Sergeant James J. Toner	Philadelphia
9.	Corporal William E. Straw	Philadelphia
10.	Corporal William M. Hopkins	Philadelphia
11.	Corporal George B. Brooke	Philadelphia
12.	Corporal Arthur N. Arnwine	Philadelphia
13.	Corporal George B. Cushing	Philadelphia
14.	Corporal Henry S. Thompson	Philadelphia
15.	Corporal Arthur N. Rann	Philadelphia
16.	Mechanic John Franco	Philadelphia
17.	Musician Robert Graham	Philadelphia
18.	Musician Charles W. Tuttle	Philadelphia
19.	First-class Private James Alexander	Philadelphia
20.	First-class Private Jerome Berkowitz	Philadelphia
21.	First-class Private John Bogden	Philadelphia
22.	First-class Private Joseph Harris	Philadelphia
23.	First-class Private Harry S. Keffer	Philadelphia
24.	First-class Private William Kinnes	Philadelphia
25.	First-class Private Albert W. Lancaster	Philadelphia
26.	First-class Private Thomas J. Murphy	Philadelphia
27.	First-class Private William J. Ruch	Philadelphia
28.	First-class Private Max Schrepfer	Philadelphia
29.	First-class Private Harry Schlecht	Philadelphia
30.	First-class Private James W. Smith	Philadelphia
31.	First-class Private Carl F. Wacker	Philadelphia
32.	First-class Private Leonard N. Wilson	Philadelphia
33.	First-class Private William F. Volz	Philadelphia
34.	Private Elton R. Armstrong	Philadelphia
35.	Private Nicholas T. Attubato	Philadelphia
36.	Private Joseph W. Besselle	Philadelphia
37.	Private Isreal Bleiweis	Philadelphia
38.	Private Joseph B. Blossom	Philadelphia



Company F, 1st Pennsylvania Infantry

(CONTINUED)

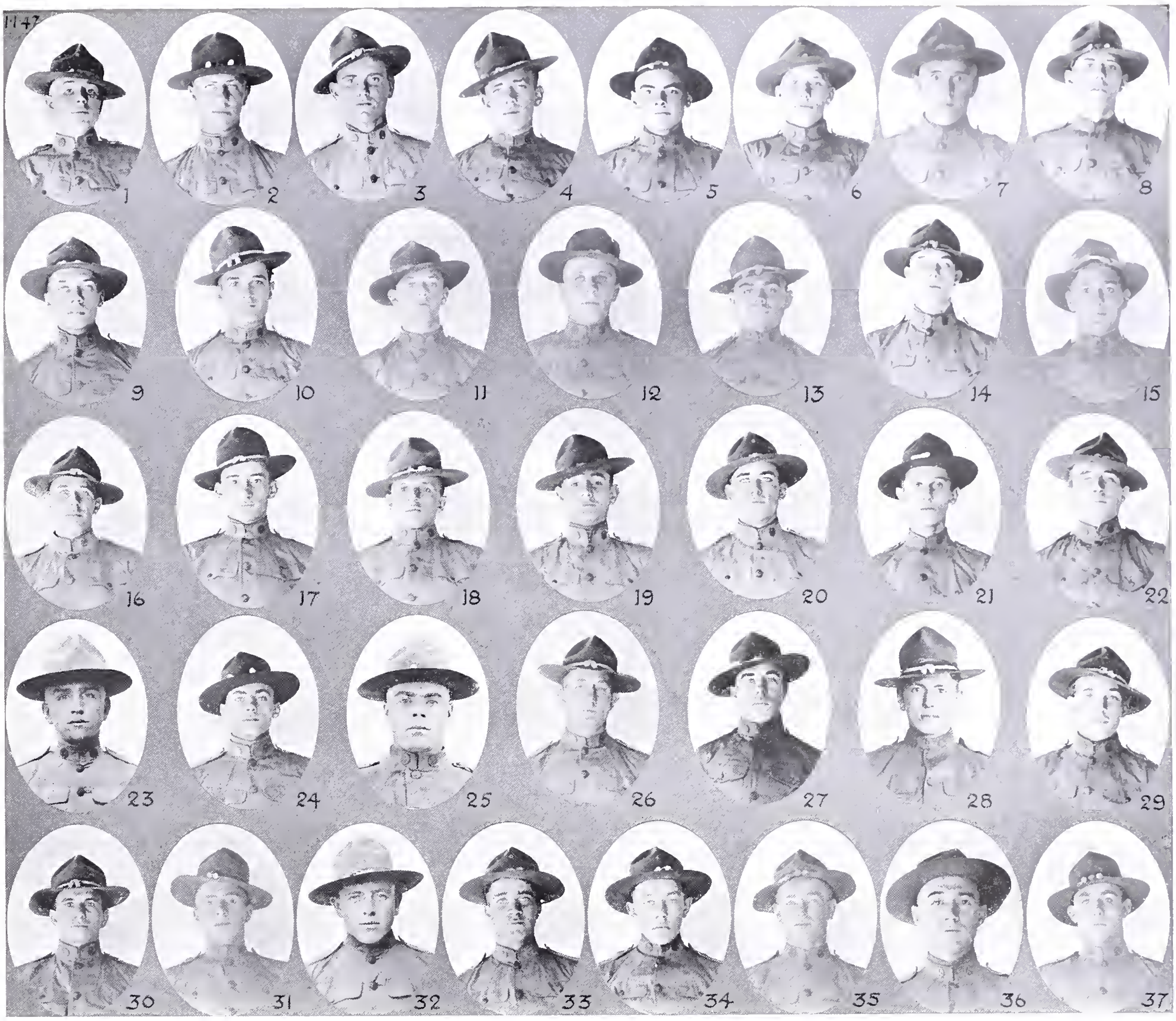
1.	Private Charles Bevins	
2.	Private Hugh J. Boyle	Philadelphia
3.	Private John A. Brady	Philadelphia
4.	Private John F. Brunner	Philadelphia
5.	Private Maurice Carson	Philadelphia
6.	Private Preston Chambers	Philadelphia
7.	Private William H. Coble	Glenolden, Pa.
8.	Private Raymond Conley	Philadelphia
9.	Private Elwood L. Connelly	Philadelphia
10.	Private Jos. W. Criswell	Philadelphia
11.	Private James J. Cullinan	Philadelphia
12.	Private J. Wesley Davies	Philadelphia
13.	Private Warren R. Davis	Philadelphia
14.	Private Frank M. Denning	Philadelphia
15.	Private Francis Devlin	Philadelphia
16.	Private Joseph O. Dewees	Jenkintown, Pa.
17.	Private Elmer A. Diehl	Philadelphia
18.	Private Joseph Distefano	Philadelphia
19.	Private Harry Dittus	Philadelphia
20.	Private Isadore Drapkin	Philadelphia
21.	Private John Egner	Philadelphia
22.	Private Edward J. Ehman	Philadelphia
23.	Private John Engelke	Philadelphia
24.	Private Edward J. Ervin	Philadelphia
25.	Private George F. Fidler	Philadelphia
26.	Private George J. Fitzpatrick	Philadelphia
27.	Private Harry A. Fleming	Philadelphia
28.	Private John J. Flynn	Philadelphia
29.	Private John F. Fox	Philadelphia
30.	Private George Y. Funk	Roxborough, Pa.
31.	Private Anthony M. Gannon	Philadelphia
32.	Private Peter P. Gelzinis	Philadelphia
33.	Private Eugene J. Gillepsie	Philadelphia
34.	Private H. Rowland Gross	Philadelphia
35.	Private H. Gottschall	Reading, Pa.
36.	Private Thomas E. Hallowell	Glenside, Pa.
37.	Private Charles E. Hart	Philadelphia



Company F, 1st Pennsylvania Infantry

(CONTINUED)

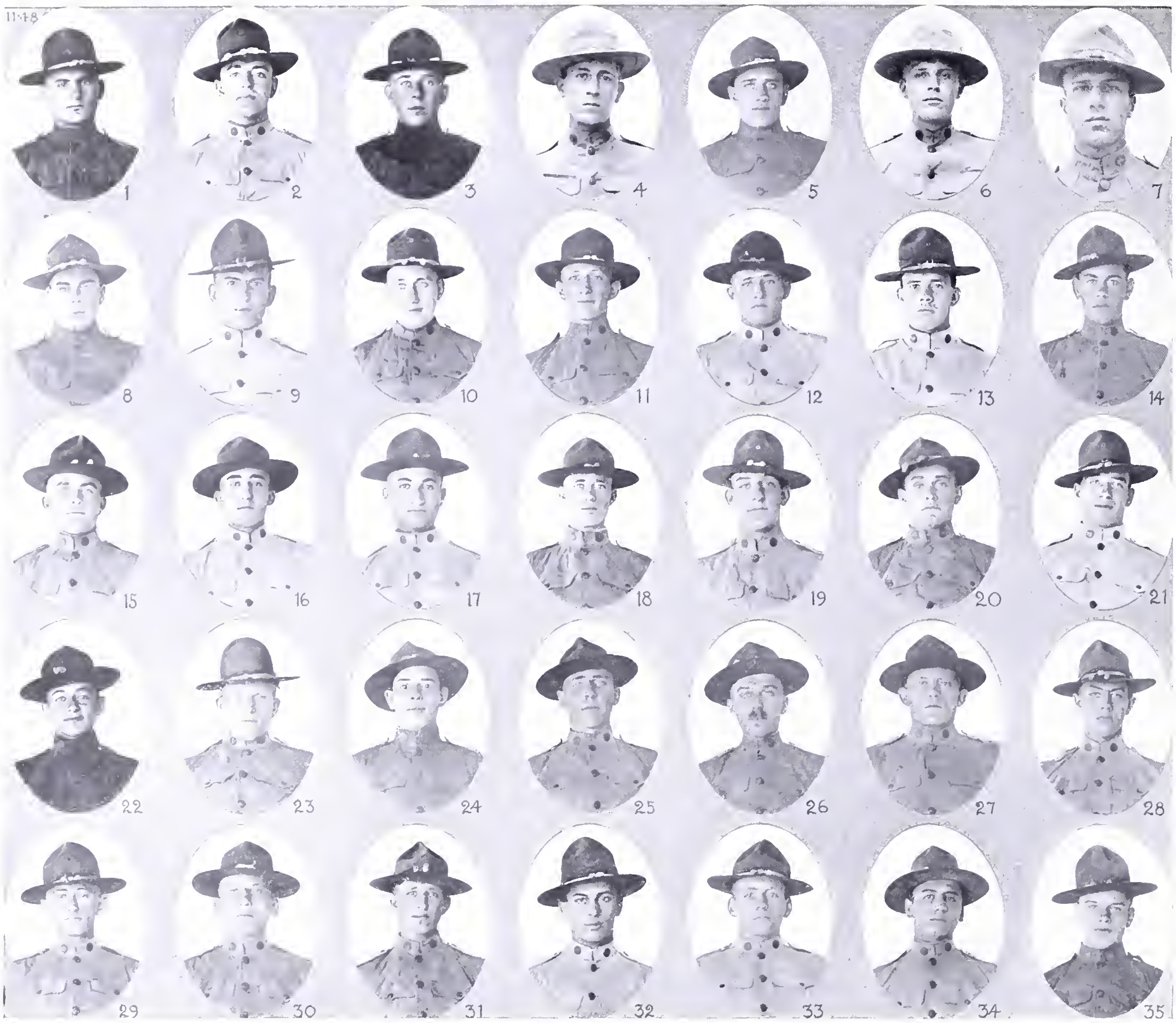
1.	Private William W. Hart	Philadelphia
2.	Private Theodore A. Hendry	Philadelphia
3.	Private Edward Howard	Philadelphia
4.	Private James H. Hustis	Philadelphia
5.	Private William F. Inge	Crowe, Va.
6.	Private Leon Jacobs	Philadelphia
7.	Private James J. Kane	Philadelphia
8.	Private Wesley J. Kauffman	Rising Sun, Md.
9.	Private John J. Kearney	Philadelphia
10.	Private Joseph D. Kent	Philadelphia
11.	Private Harry H. Kincade	Manayunk, Pa.
12.	Private Jacob R. Kindig	Philadelphia
13.	Private William G. Kirschner	Philadelphia
14.	Private George T. Knoll	Philadelphia
15.	Private Alexander S. Kolf	Philadelphia
16.	Private Lewis Kramer	Philadelphia
17.	Private John Lightheart	Philadelphia
18.	Private Earl K. Lemmon	East Downington, Pa.
19.	Private George A. Leslie	Coatesville, Pa.
20.	Private Joseph Little	Philadelphia
21.	Private Napoleon W. Lussier	Philadelphia
22.	Private Vincent Lynn	Philadelphia
23.	Private Marcus McCallum	Philadelphia
24.	Private James McGowan	Philadelphia
25.	Private Jos. T. McSorley	Philadelphia
26.	Private Edmund C. Meyer	Philadelphia
27.	Private Berl H. Maguire	Philadelphia
28.	Private Sylvester Mahon	Roxborough, Pa.
29.	Private Benjamin J. Markward	Coatesville, Pa.
30.	Private James J. Martin	Philadelphia
31.	Private Louis C. Martin	Philadelphia
32.	Private Benjamin F. Miller	Kennett Square, Pa.
33.	Private Richard Miller	Manayunk, Pa.
34.	Private George A. Morrison	Philadelphia
35.	Private James Muller	Andalusia, Pa.
36.	Private William Muller	Philadelphia
37.	Private James Mosero	Philadelphia
38.	Private David Muir	Philadelphia



Company F, 1st Pennsylvania Infantry

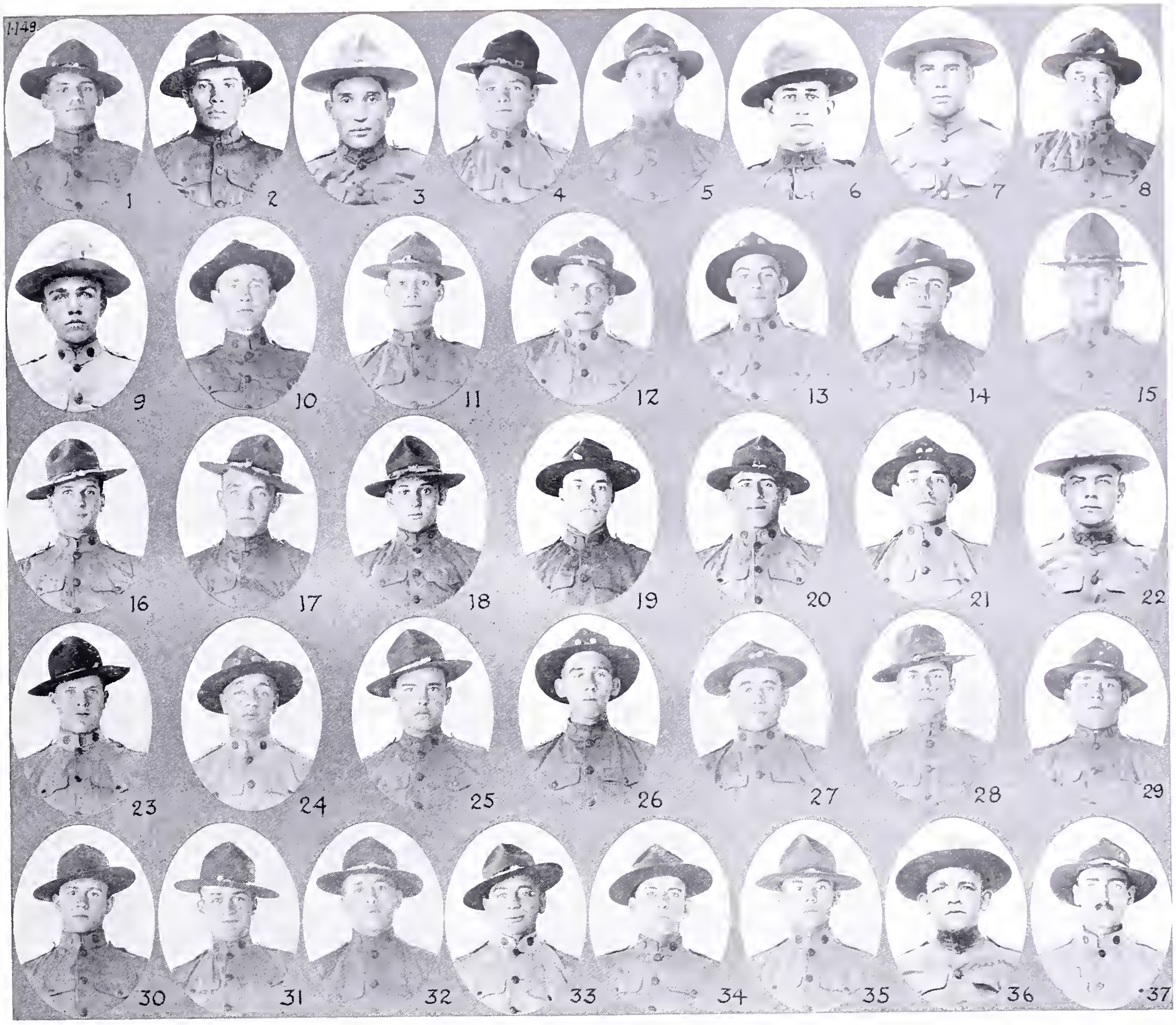
(CONTINUED)

1.	Private Charles J. Nean	Philadelphia
2.	Private L. E. Nichols	
3.	Private Albert O'Geary	Virgilina, Va.
4.	Private Francis A. O'Hara	Philadelphia
5.	Private R. Pierce	Camden, N. J.
6.	Private Ernest O. Peterman	Philadelphia
7.	Private Louis C. Peterman	Philadelphia
8.	Private William C. Peters	Philadelphia
9.	Private Harold W. Pownall	Philadelphia
10.	Private Joseph G. Rizzo	Philadelphia
11.	Private Walter J. Robinson	Philadelphia
12.	Private William E. Roebuck	Philadelphia
13.	Private Morris Rose	Philadelphia
14.	Private W. A. Sadler	Philadelphia
15.	Private George Shadel	Philadelphia
16.	Private Joseph G. Schwindt	Frankford, Pa.
17.	Private Oscar Silverman	Philadelphia
18.	Private Daniel Snyder	Philadelphia
19.	Private Samuel M. Snyder	Philadelphia
20.	Private Clarence C. Speak	Philadelphia
21.	Private Alexander S. Stein	Philadelphia
22.	Private Walter R. Stiles	San Diego, Cal.
23.	Private William Schwartz	Philadelphia
24.	Private James E. Summers	Philadelphia
25.	Private Bernard Swartz	Downingtown, Pa.
26.	Private Lemuel E. Titus	Philadelphia
27.	Private Frank Toner	Philadelphia
28.	Private Theodore Tremblay	Philadelphia
29.	Private Thomas M. Troy	Philadelphia
30.	Private James Viggiano	Philadelphia
31.	Private Theodore W. Volz	Roxborough, Pa.
32.	Private James K. Wheatley	Tamaqua, Pa.
33.	Private Frank Winkelspecht	McKinley, Pa.
34.	Private Russell N. Worman	Philadelphia
35.	Private Howard G. Wright	Coatesville, Pa.
36.	Private William L. Young	Philadelphia
37.	Private Walter Zimmerman	Philadelphia



Company G, 1st Pennsylvania Infantry

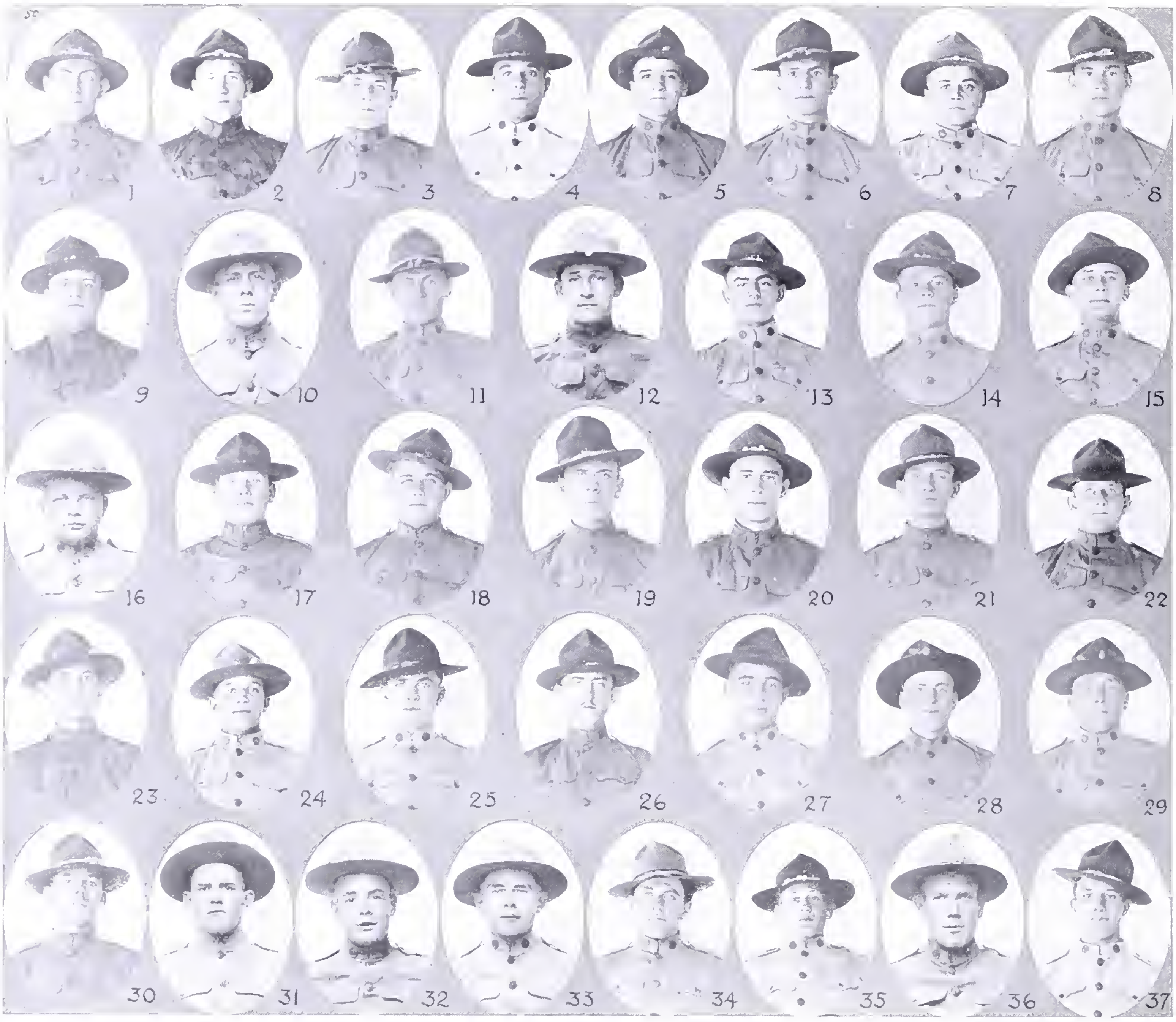
1.	First Sergeant Gustave C. Reidel	Egg Harbor City, N. J.
2.	Mess Sergeant George W. Phillips	Philadelphia
3.	Supply Sergeant Charles H. Middleton	Philadelphia
4.	Sergeant Rudolph F. Haar	Philadelphia
5.	Sergeant Graham McConnell	Philadelphia
6.	Sergeant Earl H. Prentzel	Willow Grove, Pa.
7.	Sergeant Harold A. Fahr	Willow Grove, Pa.
8.	Sergeant Albert D. Henze	Philadelphia
9.	Sergeant Walter S. Bates	Philadelphia
10.	Corporal William P. Wilson	Philadelphia
11.	Corporal Frederick E. Bauer	Philadelphia
12.	Corporal Theodore F. Smythe	Philadelphia
13.	Corporal Ferdinand J. Wolfram, Jr.	Philadelphia
14.	Corporal Raymond A. Conrow	Burlington, N. J.
15.	Corporal Melvin R. Giberson	Williamstown, N. J.
16.	Corporal Joseph V. Reed	Philadelphia
17.	Mechanic Charles Fine	Philadelphia
18.	Cook Hugh McQuiston	Philadelphia
19.	Cook Frederick J. Weldon	Philadelphia
20.	Cook Harry B. Worthington	Clifton Heights, Pa.
21.	Bugler Paul A. Baker	Philadelphia
22.	Bugler Howard W. Munder	Philadelphia
23.	First-class Private Nathan Blankley	Philadelphia
24.	First-class Private Layton A. Conard	Philadelphia
25.	First-class Private Frank S. Fagg	Philadelphia
26.	First-class Private David D. Fairchild	Philadelphia
27.	First-class Private Elmer Hayward	Philadelphia
28.	First-class Private Harry B. Hornickel	Philadelphia
29.	First-class Private Julius Jacobs	Royersford, Pa.
30.	First-class Private Arthur D. Knight	Philadelphia
31.	First-class Private John H. McQuiston	Narberth, Pa.
32.	First-class Private Samuel N. Morrone	Philadelphia
33.	First-class Private John C. Naye	Philadelphia
34.	First-class Private Lester F. Reamer	Philadelphia
35.	First-class Private Albert R. Taylor	Philadelphia



Company G, 1st Pennsylvania Infantry

(CONTINUED)

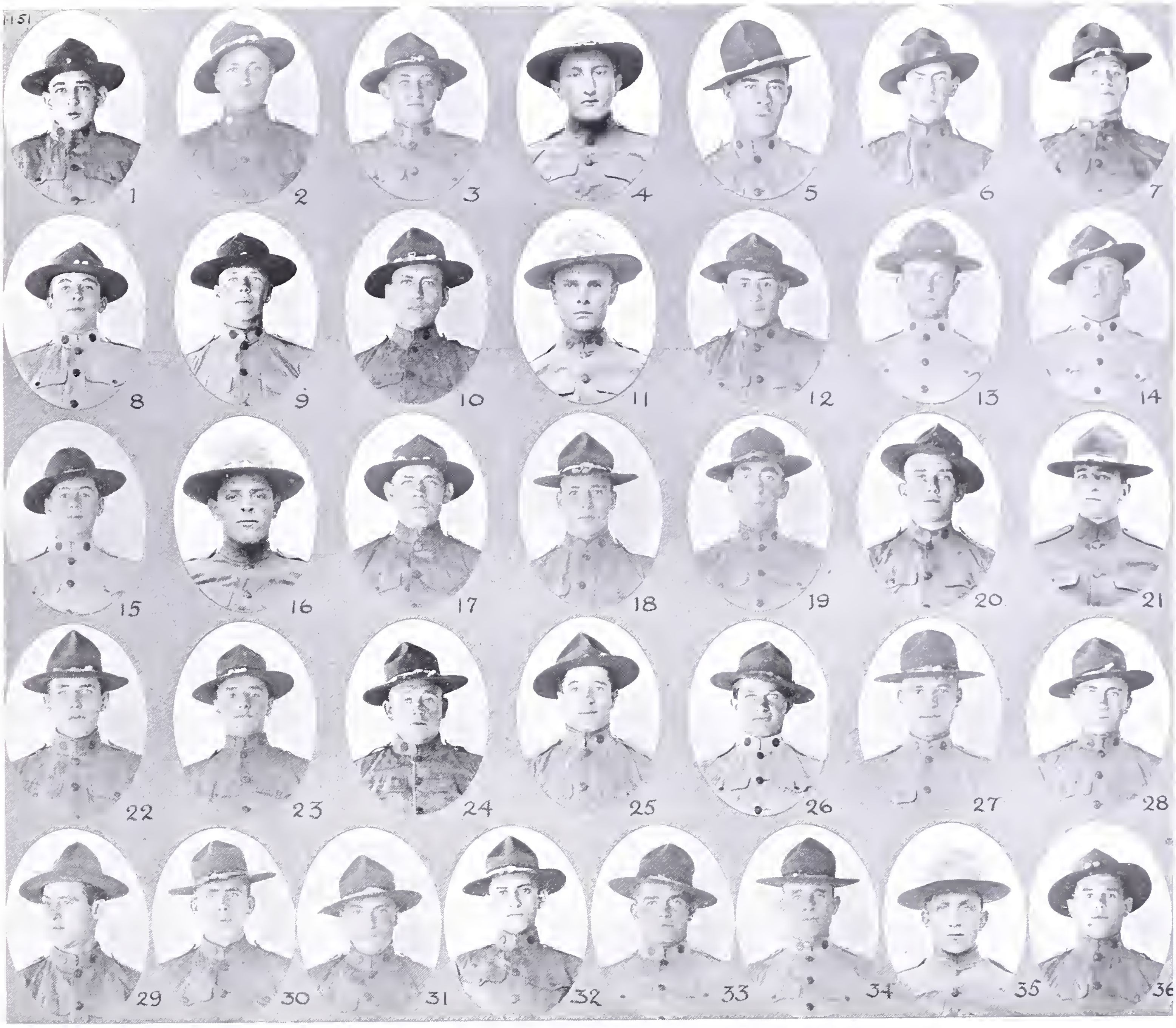
1.	Private William T. Adolph	Philadelphia
2.	Private John P. Aigler	Beavertown, Pa.
3.	Private I. Barrett	Philadelphia
4.	Private Vincent Bambrick	Philadelphia
5.	Private Samuel Bechtel	Reading, Pa.
6.	Private Frank W. Berkenstock	Philadelphia
7.	Private Samuel E. Bewley	Oakview, Pa.
8.	Private Asa J. Bice	Philadelphia
9.	Private Thomas E. Biddle	Philadelphia
10.	Private Lyman Biggs	Lancaster, Pa.
11.	Private Horms Blumberg	Philadelphia
12.	Private Theodore L. Brichette	Philadelphia
13.	Private Robert H. Brous	Philadelphia
14.	Private George M. Burger	Philadelphia
15.	Private George J. Bruecks	Philadelphia
16.	Private C. Brooks	Philadelphia
17.	Private John M. Calhoun	Philadelphia
18.	Private Nathan Carver	Philadelphia
19.	Private Alfred H. Caterson	Philadelphia
20.	Private Philip F. Checchio	Philadelphia
21.	Private Vincent Coia	Philadelphia
22.	Private Charles A. Coskey	Philadelphia
23.	Private Charles F. Collins	Philadelphia
24.	Private Clement Cronin	Philadelphia
25.	Private William Day	Franklinville, N. Y.
26.	Private Harry De Brunner	Clifton Heights, Pa.
27.	Private Antonio Desantis	Temple, Pa.
28.	Private Adolph Diaz	Philadelphia
29.	Private Howard Diehl	Philadelphia
30.	Private Norman K. Diehl	Philadelphia
31.	Private Harry Dietrich	Reading, Pa.
32.	Private Robert C. Dilks	Philadelphia
33.	Private Michale F. Dinardo	Philadelphia
34.	Private Charles F. Downs	Williamstown, N. J.
35.	Private Thomas Drewes	Philadelphia
36.	Private William Dwyer	Philadelphia
37.	Private Raymond A. Edelman	Philadelphia



Company G, 1st Pennsylvania Infantry

(CONTINUED)

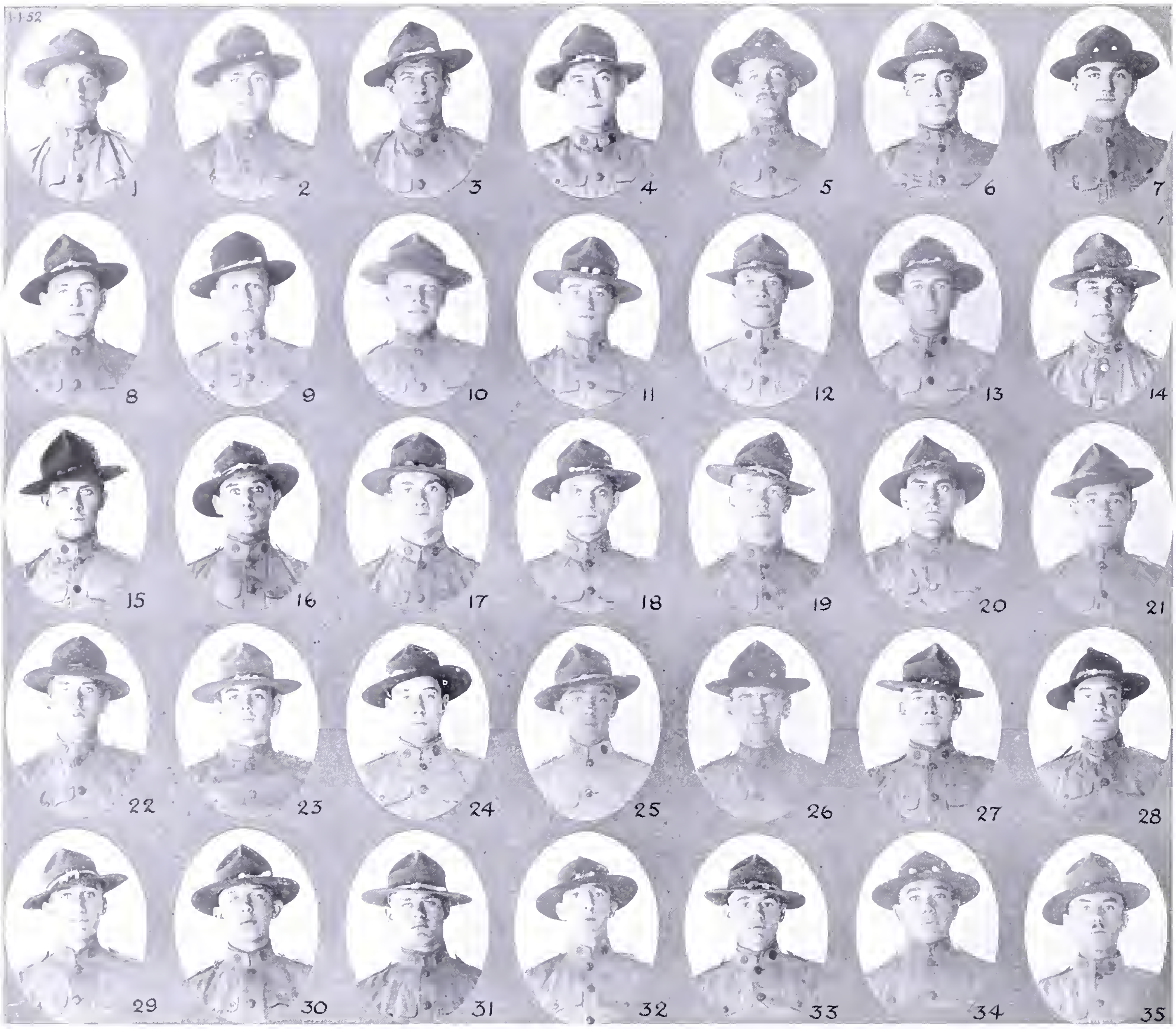
1.	Private Clarence Eisenbise	Reading, Pa.
2.	Private Austin D. Fahr	Philadelphia
3.	Private Gus A. Faulkner	Philadelphia
4.	Private Philip Field	Philadelphia
5.	Private Harold R. Forman	Philadelphia
6.	Private Norman Forr	Philadelphia
7.	Private Michael Gawowski	Reading, Pa.
8.	Private Frederick C. Glenn	Philadelphia
9.	Private Edwin Gravell	Philadelphia
10.	Private August Greway	Philadelphia
11.	Private James C. Griffin	Philadelphia
12.	Private William Hart	Philadelphia
13.	Private John Shindler	Philadelphia
14.	Private George L. Hofaker	Philadelphia
15.	Private John W. Hoover	Philadelphia
16.	Private John A. Hogan	Philadelphia
17.	Private Bernard C. Horan	Philadelphia
18.	Private Alvin H. Housey	Philadelphia
19.	Private E. Houseman	Philadelphia
20.	Private Louis W. Kaiser	Philadelphia
21.	Private Joseph Keegan	Philadelphia
22.	Private Horace E. Kelley	Philadelphia
23.	Private Charles Knapp	Philadelphia
24.	Private George J. Kuni	Philadelphia
25.	Private Edmund D. Lear	Aldan, Pa.
26.	Private Harold S. Logan	Philadelphia
27.	Private Charles Lohmiller, Jr.	Philadelphia
28.	Private Charles Lord	Clifton Heights, Pa.
29.	Private Herman Lowry	Philadelphia
30.	Private Harry Lutes	Philadelphia
31.	Private J. McDermott	Philadelphia
32.	Private Jas. M. McNamara	Philadelphia
33.	Private Frank M. McNamee	Philadelphia
34.	Private Walter R. McDougall	Philadelphia
35.	Private Robert P. Maxwell	Philadelphia
36.	Private Rex Morrow	Philadelphia
37.	Private Edward Nerger	Philadelphia



Company G, 1st Pennsylvania Infantry

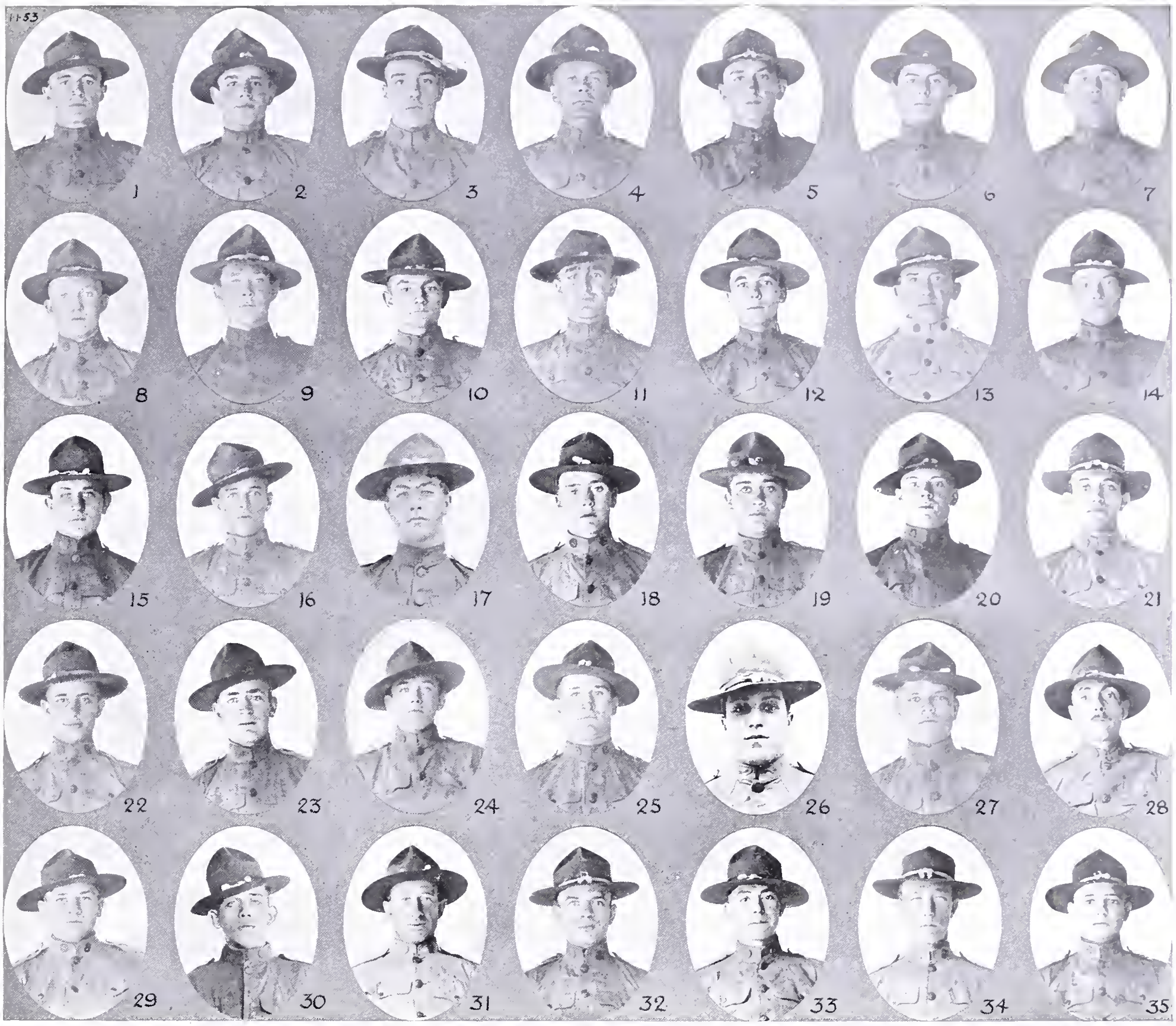
(CONTINUED)

1.	Private William O'Brien	Philadelphia
2.	Private Charles Oxenford	Temple, Pa.
3.	Private John Pinkos	Philadelphia
4.	Private Charles Quenser	Philadelphia
5.	Private August William Ryne	Philadelphia
6.	Private Frank J. Russell	Philadelphia
7.	Private Walter Saylor	Philadelphia
8.	Private John P. Sharpe	Philadelphia
9.	Corporal Chandler W. Shaw	Philadelphia
10.	Private Clarence J. Shaw	Philadelphia
11.	Private Raymond Shay	Philadelphia
12.	Private Bernett Secouler	Philadelphia
13.	Private Paul L. Shearer	Philadelphia
14.	Private Dennis Sheenan	Philadelphia
15.	Private Bertus Shepherdson	Philadelphia
16.	Private Carl W. Skelton	Philadelphia
17.	Private John A. Smith	Philadelphia
18.	Private John C. Struse	Philadelphia
19.	Private Edward F. Supplee	Philadelphia
20.	Private Edward J. Sweeney	Philadelphia
21.	Private W. E. Stephens	Philadelphia
22.	Private Arthur M. Taylor	Beverly, N. J.
23.	Private William Tinsman	Philadelphia
24.	Private Joseph H. Tischner	Philadelphia
25.	Private Adolph Venus	Philadelphia
26.	Private Charles Walton	Philadelphia
27.	Private David E. Watson	Philadelphia
28.	Private Horace Weigelt	Collingdale, N. J.
29.	Private John Wells	Philadelphia
30.	Private Willis L. Wells	Philadelphia
31.	Private Roy A. Whitehead	Philadelphia
32.	Private Harry D. Winslow	Philadelphia
33.	Private John Winthrop	Bryn Mawr, Pa.
34.	Private William W. Wright	Philadelphia
35.	Private Frank Whatley	Philadelphia
36.	Private Abraham Zussman	Detroit, Mich.



Company H, 1st Pennsylvania Infantry

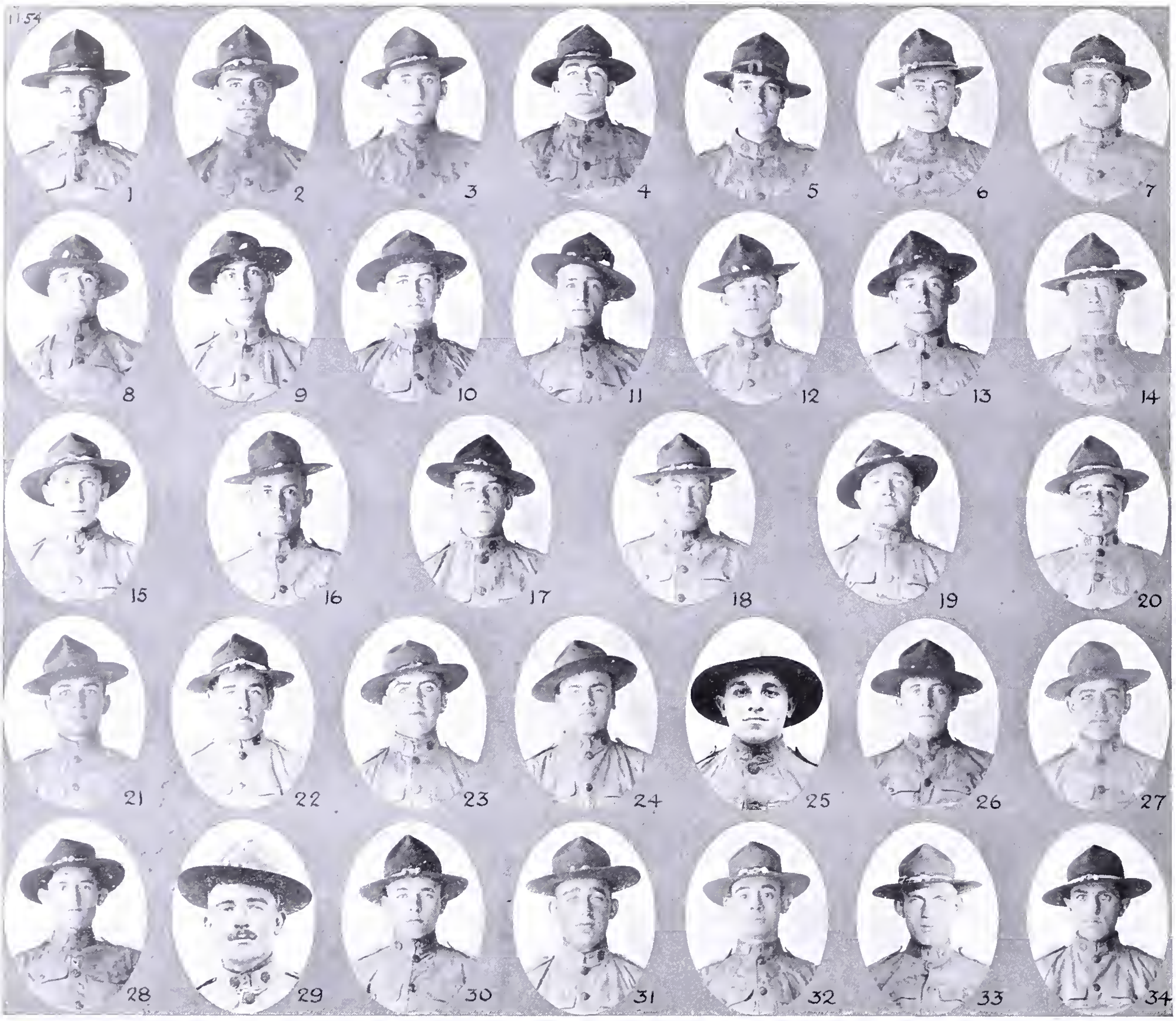
1.	First Sergeant John Schmidt	Philadelphia
2.	Supply Sergeant Charles E. Rambo	Philadelphia
3.	Mess Sergeant Frank K. Turner	Philadelphia
4.	Sergeant Joseph D. Kennedy	Philadelphia
5.	Sergeant John S. Clark	Philadelphia
6.	Sergeant Charles S. Kennedy	Philadelphia
7.	Corporal Albert C. Liebert	Philadelphia
8.	Corporal James R. Nolen	Philadelphia
9.	Corporal Charles S. Justice	Camden, N. J.
10.	Corporal Edward H. Keller	Philadelphia
11.	Corporal William L. Corwell	Philadelphia
12.	Corporal Harry Shields	Philadelphia
13.	Corporal Eugene H. Ashley	Philadelphia
14.	Corporal Godfrey Meir	Philadelphia
15.	Cook John F. Devine	Philadelphia
16.	Cook Maurice Manasse	Philadelphia
17.	Mechanic Thomas J. Hannon	Philadelphia
18.	Bugler Clarence Crane	Philadelphia
19.	First-class Private Walter E. Achuff	Philadelphia
20.	First-class Private Manuel Alvarez	Philadelphia
21.	First-class Private Hymen Benedict	Philadelphia
22.	First-class Private Thomas J. Bowen	Philadelphia
23.	First-class Private Fred H. Decker	Philadelphia
24.	First-class Private Joseph Donohue	Cornwells, Pa.
25.	First-class Private Edwin F. Durnbaugh	Philadelphia
26.	First-class Private William R. Gibson	Philadelphia
27.	First-class Private Walter Henrie	Philadelphia
28.	First-class Private Joseph H. Hollywood	Philadelphia
29.	First-class Private John S. King	Philadelphia
30.	First-class Private Adam W. Kowalski	Philadelphia
31.	First-class Private Carl C. Lenz	Philadelphia
32.	First-class Private Edward McGovern	Philadelphia
33.	First-class Private William J. McDermott	Philadelphia
34.	First-class Private Jacob Musicant	Philadelphia
35.	First-class Private Richard Pearson	Philadelphia



Company H, 1st Pennsylvania Infantry

(CONTINUED)

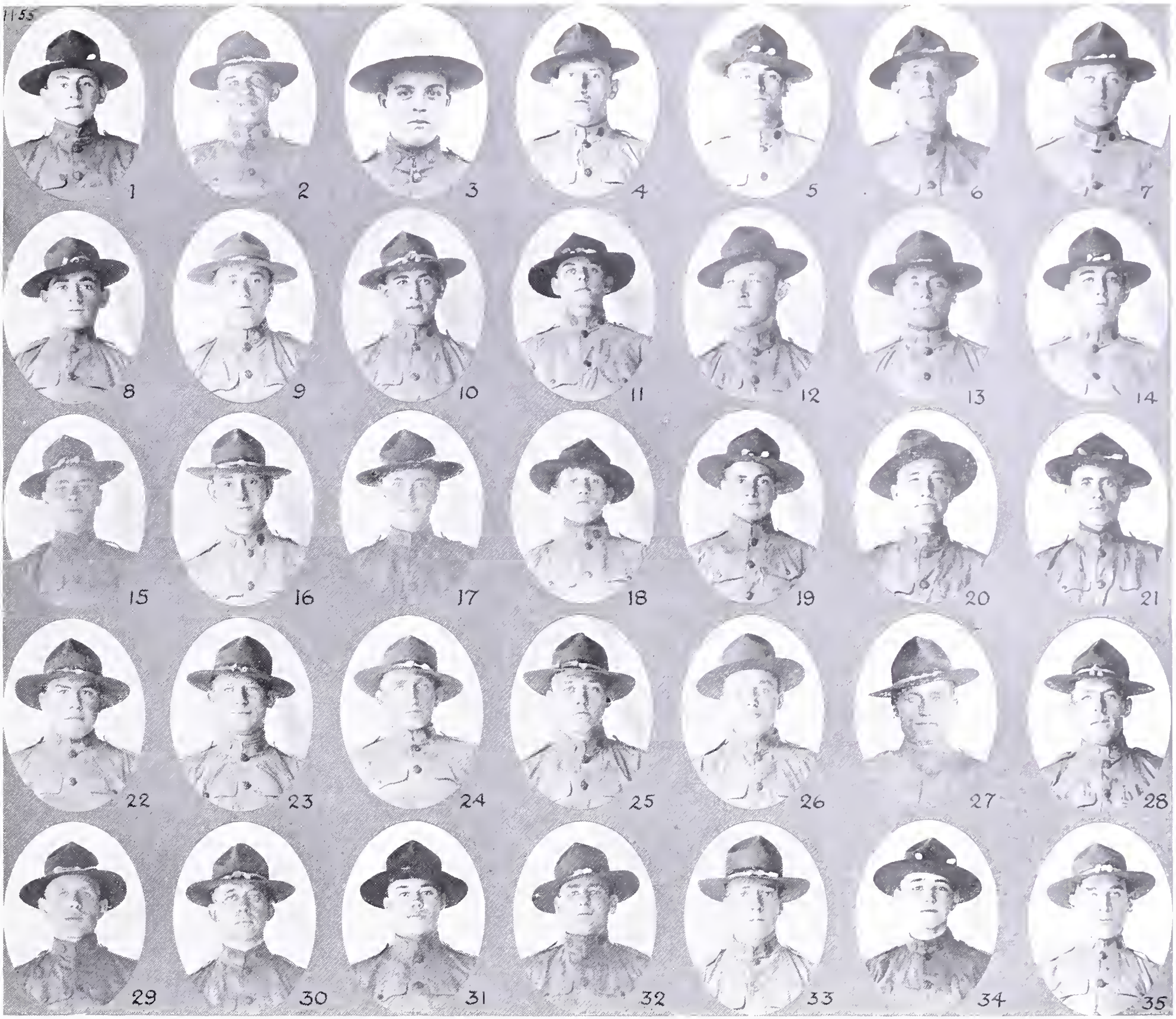
1.	Private Walter Abrahams	Philadelphia
2.	Private Michael Altieruy	Philadelphia
3.	Private Joseph Atkinson	Philadelphia
4.	Private George Arcand	Philadelphia
5.	Private Joseph Beishl	Philadelphia
6.	Private Israel Berg	Philadelphia
7.	Private Edward Brower	Philadelphia
8.	Private Walter S. Bruce	Philadelphia
9.	Private Edgar J. Call	Philadelphia
10.	Private Leroy Carr	Beverly, N. J.
11.	Private Frank J. Chapman	Philadelphia
12.	Private William Chapman	Philadelphia
13.	Private Morris Cohen	Philadelphia
14.	Private John Conley	Philadelphia
15.	Private Hugh Cooper	Philadelphia
16.	Private Edward Creeley	Philadelphia
17.	Private William Cusick	Philadelphia
18.	Private John F. Donnelly	Philadelphia
19.	Private Charles W. Dorittee	Philadelphia
20.	Private William Elbrison	Philadelphia
21.	Private Joseph Flanigan	Philadelphia
22.	Private Fred Frank	Philadelphia
23.	Private Joseph Geddes	Philadelphia
24.	Private Henry Gibat	Philadelphia
25.	Private Louis Goddard	Philadelphia
26.	Private William S. Graf	Philadelphia
27.	Private Frank Grandiske	Philadelphia
28.	Private Charles R. Gray	Philadelphia
29.	Private Joseph Gubizza	Philadelphia
30.	Private C. A. Halpen	Philadelphia
31.	Private John A. Haviland	Philadelphia
32.	Private Morris Heimerling	Philadelphia
33.	Private Albert Hipp	Philadelphia
34.	Private Albert Hildebrandt	Philadelphia
35.	Private David Hymerling	Philadelphia



Company H, 1st Pennsylvania Infantry

(CONTINUED)

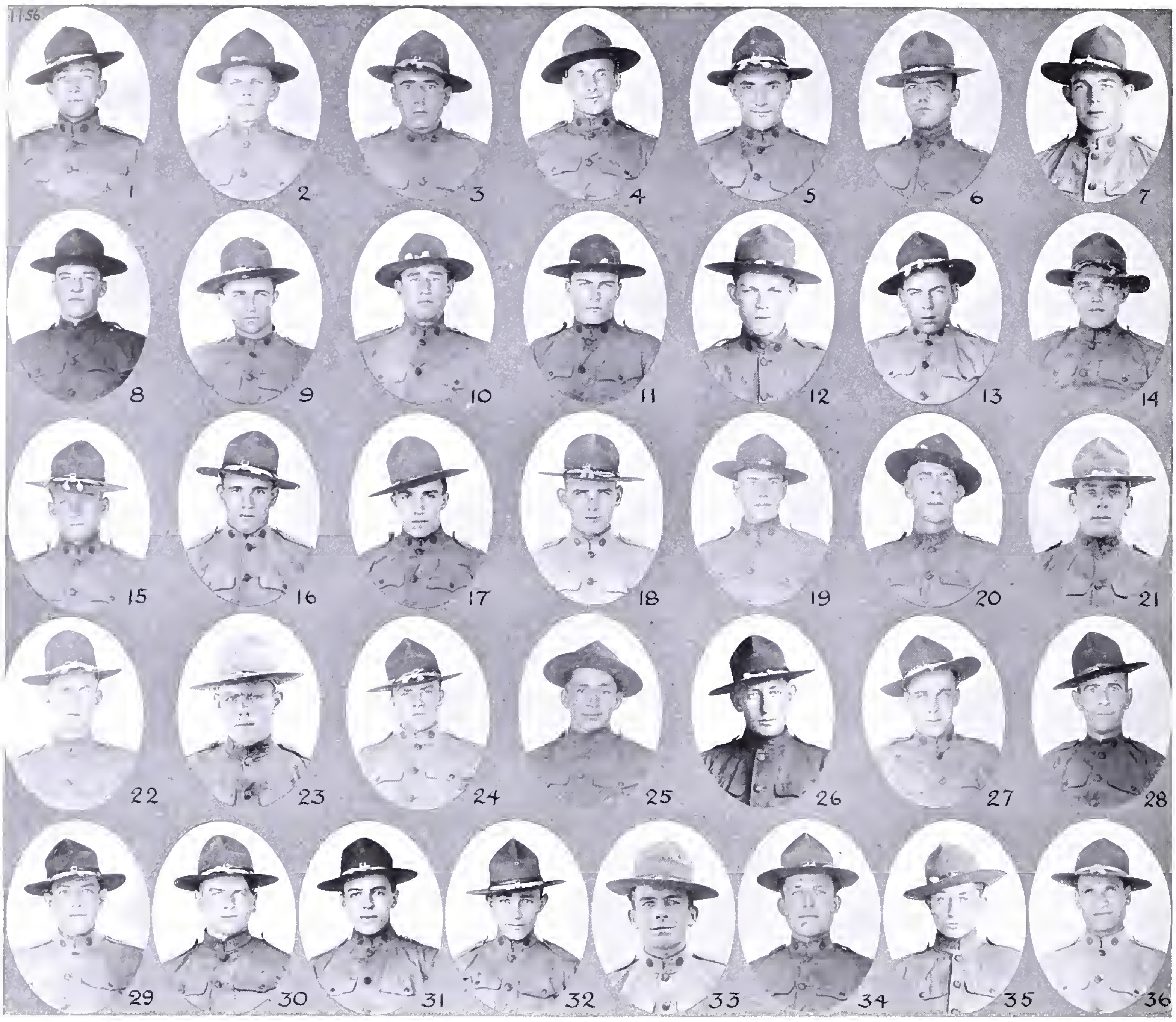
1.	Private William Ingram	Philadelphia
2.	Private C. Rizzo	Philadelphia
3.	Private Raymond Jones	Philadelphia
4.	Private Thomas W. Kelley	Philadelphia
5.	Private James Kramer	Philadelphia
6.	Private William Leahy	Philadelphia
7.	Private Samuel Lipschutz	Philadelphia
8.	Private Gardiner A. Lower	Philadelphia
9.	Private Albert Luce	Philadelphia
10.	Private George A. Lunt	Philadelphia
11.	Private Edward MacCaulley	Philadelphia
12.	Private George L. MacElroy	Philadelphia
13.	Private James Magee	Philadelphia
14.	Private Charles C. Matthews	Philadelphia
15.	Private Frank Martin	Philadelphia
16.	Private James McCloy	Philadelphia
17.	Private James McCoach	Philadelphia
18.	Private Edward M. McGuinness	New York City
19.	Private Joseph Meenan	New York City
20.	Private Martin Michael	Philadelphia
21.	Private Abraham Miller	Philadelphia
22.	Private Robert Minnis	Philadelphia
23.	Private Robert Morrison	Philadelphia
24.	Private Russell Moore	Philadelphia
25.	Private Edward Neiditch	Philadelphia
26.	Private George Naulty	Sepwia, Pa.
27.	Private Charles Nicholas	Philadelphia
28.	Private Francis Ottinger	Philadelphia
29.	Private Francis Place	Ocean City, N. J.
30.	Private Charles B. Prince	Philadelphia
31.	Private James O. Pullen	Philadelphia
32.	Private Ray Ratcliffe	Philadelphia
33.	Private Charles Reibow	Philadelphia
34.	Private William Richards	Philadelphia



Company H, 1st Pennsylvania Infantry

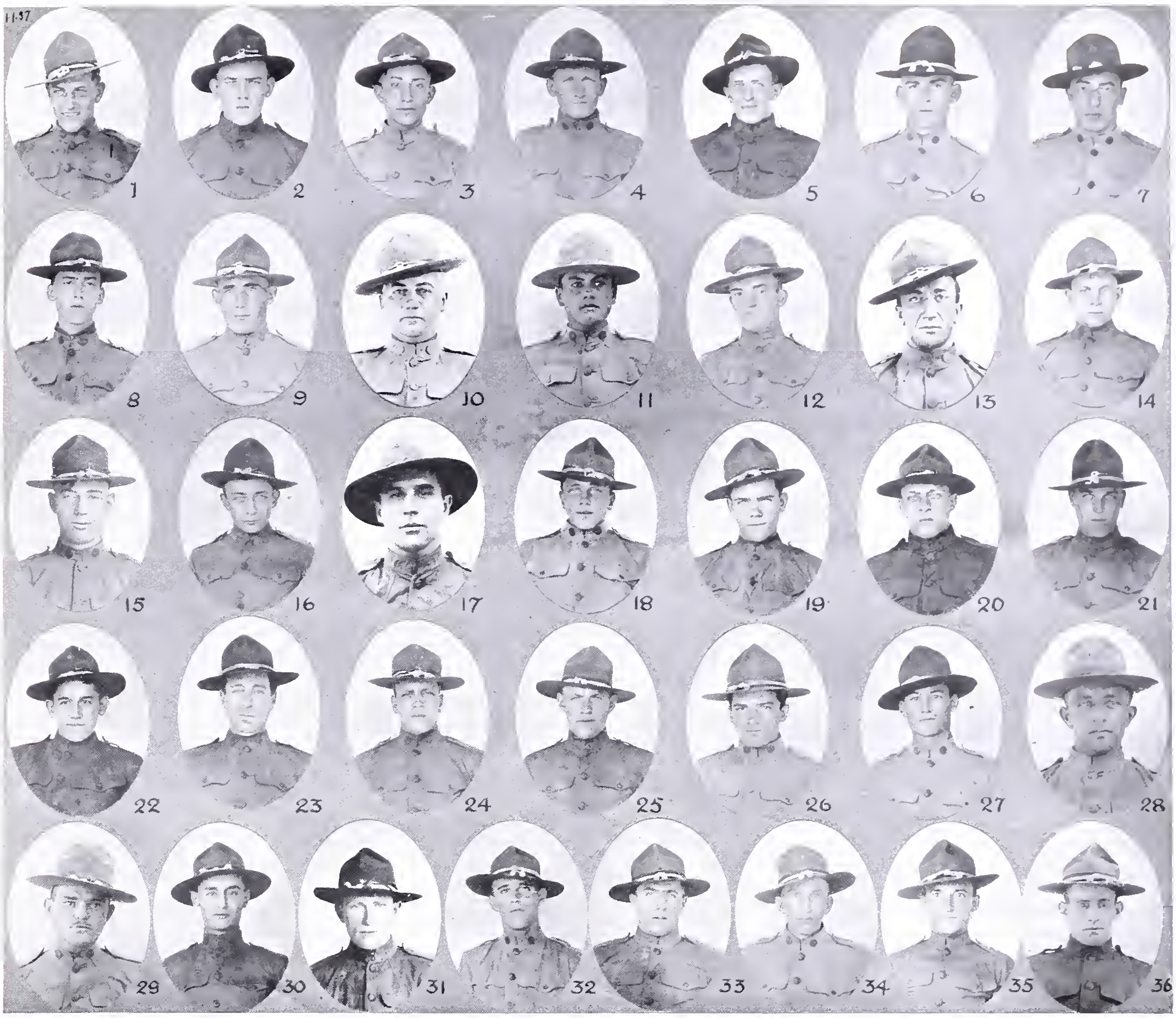
(CONTINUED)

1.	Private Elwood Roberts	Philadelphia
2.	Private Peter Rowe	Philadelphia
3.	Private Thomas Schofield	Philadelphia
4.	Private Harry Seaman	Philadelphia
5.	Private Abe Senecoff	Philadelphia
6.	Private Charles Schmidt	Philadelphia
7.	Private Earl Seckman	Phoenix, Va.
8.	Private Harry Sisenwine	Philadelphia
9.	Private William Shingle	Philadelphia
10.	Private Alfred Simons	Philadelphia
11.	Private Leroy Slater	Philadelphia
12.	Private Rudolph Smith	Philadelphia
13.	Private Anthony Sobeskey	Philadelphia
14.	Private Casper A. Streibig	Philadelphia
15.	Private George Strohm	Philadelphia
16.	Private Charles Suplee	Philadelphia
17.	Private John B. Suplee	Philadelphia
18.	Private Clarence Swan	Philadelphia
19.	Private John Ventura	Philadelphia
20.	Private Thomas Warwick	Philadelphia
21.	Private William Weiss	Philadelphia
22.	Private John X. White	Philadelphia
23.	Private William Whitehead	Philadelphia
24.	Private Joshua Wicks	Philadelphia
25.	Private Charles Windsor	Philadelphia
26.	Private William Winton	Philadelphia
27.	Private Charles L. Wilson	Philadelphia
28.	Private Gilbert Yost	Philadelphia
29.	Private William F. Lewis	Philadelphia
30.	Private Harry H. Clemens	Philadelphia
31.	Private James Gerhart	Philadelphia
32.	Private LeRoy Heffner	Philadelphia
33.	Private Harry Mauger	Philadelphia
34.	Private Jacob Bernstien	Philadelphia
35.	Private Raymond Strohm	Philadelphia



Company I, 1st Pennsylvania Infantry

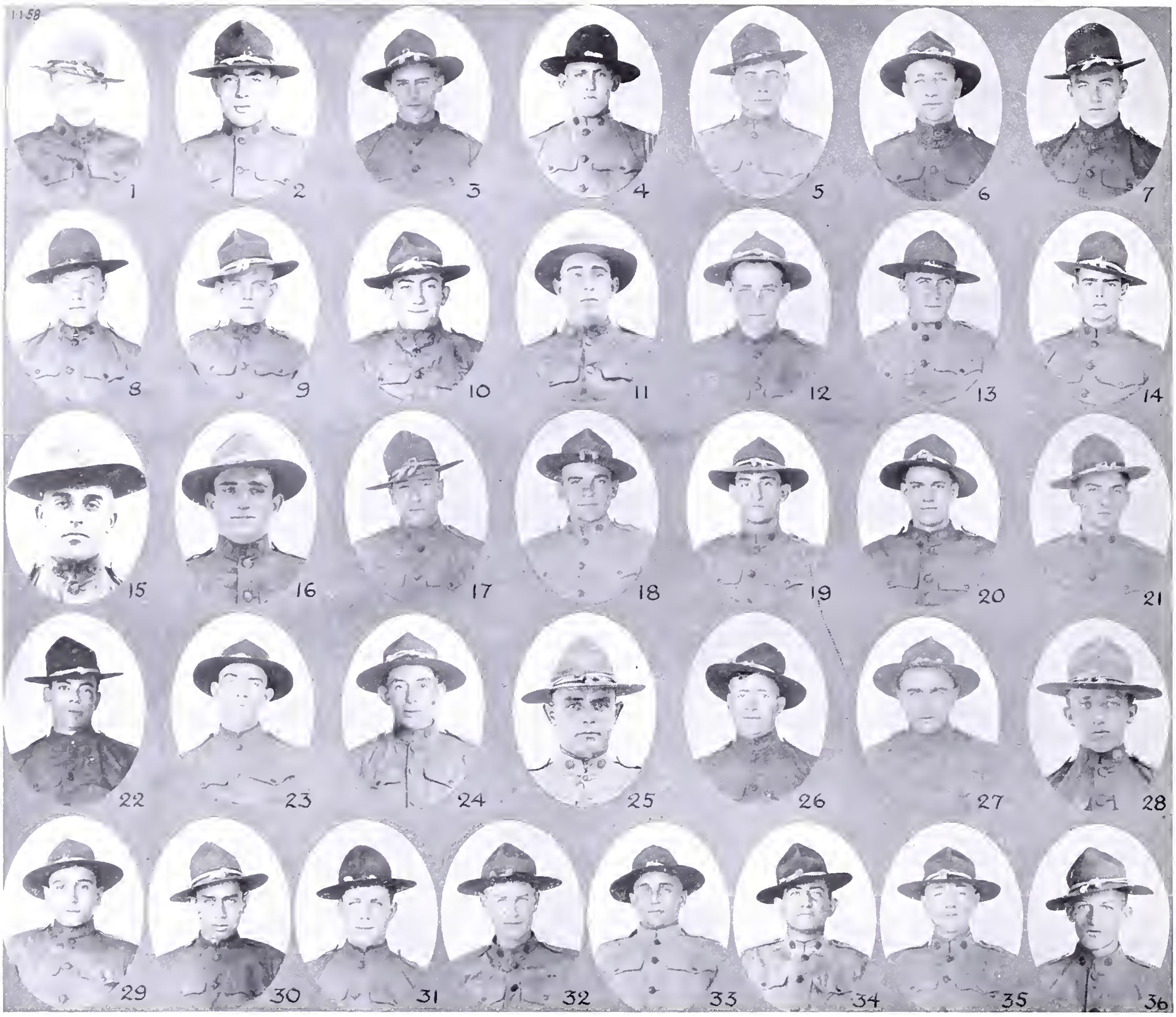
1.	First Sergeant Herman Goldstein	Philadelphia
2.	Mess Sergeant Earl Ruger	Philadelphia
3.	Supply Sergeant Harry R. Foell	Philadelphia
4.	Sergeant John V. Cain	Philadelphia
5.	Sergeant John J. Fischer	Philadelphia
6.	Sergeant James T. Spence	Primos, Pa.
7.	Sergeant Alfred N. Ruger	Philadelphia
8.	Sergeant James E. Kenney	Philadelphia
9.	Sergeant Edward Radcliffe	Philadelphia
10.	Sergeant Hazzard Melloy	Philadelphia
11.	Corporal Walter Lewis	Blackwood, N. J.
12	Corporal Franklin R. Steltz	Philadelphia
13.	Corporal William F. Keefe	Philadelphia
14.	Corporal James Bretherick	Colwyn, Pa.
15.	Corporal William R. Kane	Philadelphia
16.	Corporal James McLaughlin	Philadelphia
17.	Corporal Walter J. Lord	Philadelphia
18.	Corporal Edward Robinson	Philadelphia
19.	Corporal Paul Simpson	Philadelphia
20.	Corporal George H. Hafner	Philadelphia
21.	Corporal Edward J. Kennedy	Philadelphia
22.	Corporal J. Hiddeman	Philadelphia
23.	Corporal G. A. Pearce	Philadelphia
24.	Corporal W. Taylor	Philadelphia
25.	Bugler Harry A. Fenias	Philadelphia
26.	Bugler William R. Trantschold	Philadelphia
27.	Cook James J. Medlin	Philadelphia
28.	Cook Edward J. Lynch	Philadelphia
29.	Cook Alvin C. Ahn	
30.	Mechanic George Enz	Philadelphia
31.	Mechanic John J. Schonewolf	Philadelphia
32.	First-class Private Owen P. Brady	Philadelphia
33.	First-class Private Richard Buckley	Philadelphia
34.	First-class Private Charles Canessa	Philadelphia
35.	First-class Private Harry Diddlebock	Philadelphia
36.	First-class Private Harry Ekmekjian	Philadelphia



Company I, 1st Pennsylvania Infantry

(CONTINUED)

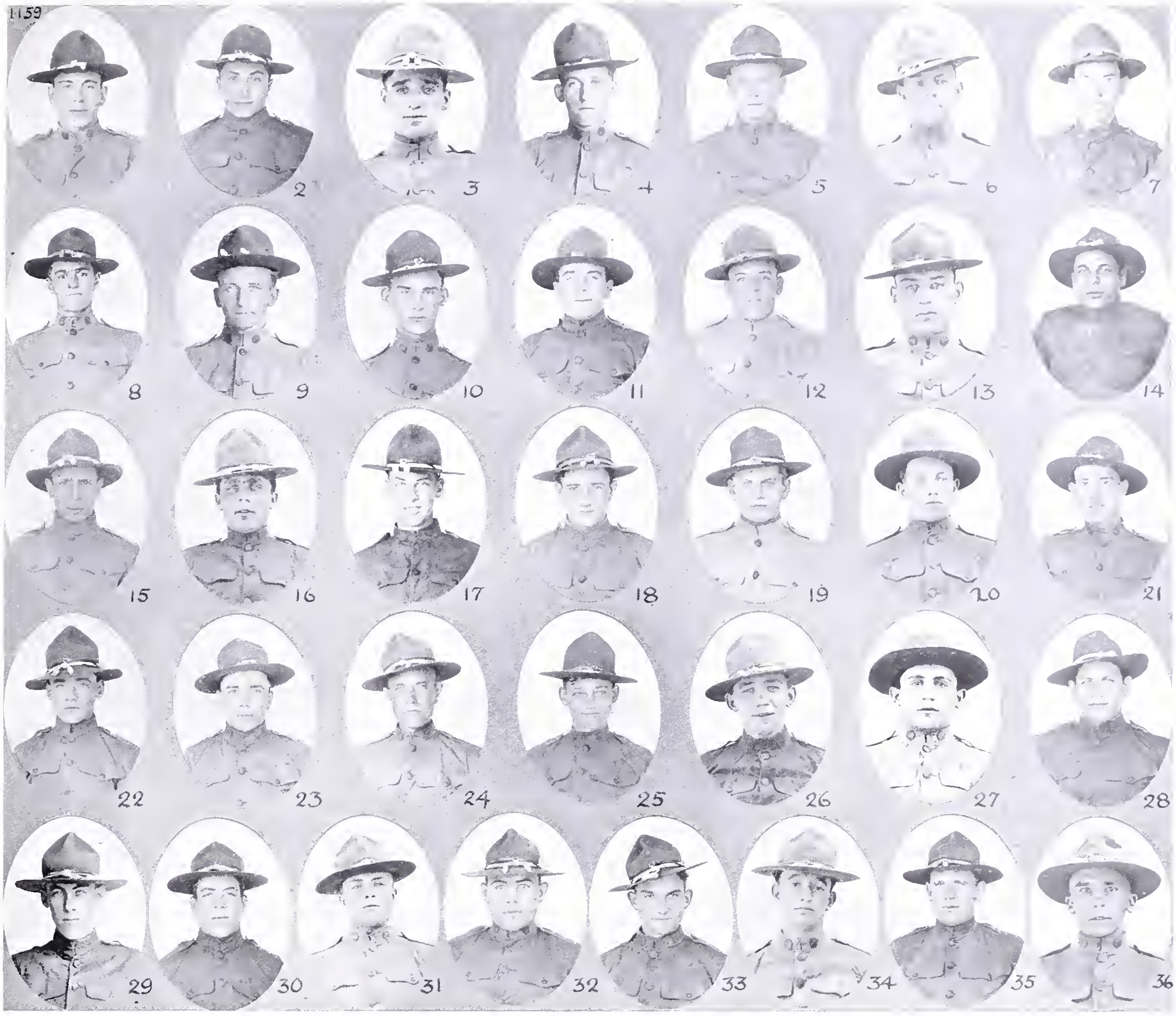
1.	First-class Private Thomas Fitzgerald	Philadelphia
2.	First-class Private Harold Gill	Berwyn, Pa.
3.	First-class Private Philip Glashoffer	Philadelphia
4.	First-class Private Robert J. Kane	Philadelphia
5.	First-class Private Donald R. Meyer	Philadelphia
6.	First-class Private Philip J. Murray	Philadelphia
7.	First-class Private Israel Shapiro	Philadelphia
8.	Private Hugh J. Algeo	Philadelphia
9.	Private Benjamin H. Anderson	Llanerch, Pa.
10.	Private William G. Barrington	Philadelphia
11.	Private Edward L. Basile	Philadelphia
12.	Private John F. Baker	Philadelphia
13.	Private Louis Becker	Philadelphia
14.	Private Edward Behm	Philadelphia
15.	Private J. Joseph Bloomer	Philadelphia
16.	Private Frederick Bosch	Philadelphia
17.	Private Frank Boyle	Philadelphia
18.	Private Allen G. Buehlar	Philadelphia
19.	Private George Burns	Philadelphia
20.	Private Roy Campbell	Philadelphia
21.	Private Charles Carr	Philadelphia
22.	Private Thomas J. Cassidy	Philadelphia
23	Private Allen Cathcart	Paoli, Pa.
24.	Private Francis Chicrano	Philadelphia
25.	Private John Currie	Philadelphia
26.	Private Anthony Day	Philadelphia
27.	Private John DeMasse	Philadelphia
28.	Private Albert L. Depman	Philadelphia
29.	Private William J. Devereaux	Philadelphia
30.	Private John J. Devern	Philadelphia
31.	Private Jeremiah Devers	Philadelphia
32.	Private Charles Dougherty	Philadelphia
33.	Private George Drautz	Philadelphia
34.	Private David Duncan	Philadelphia
35.	Private Horace Evans	Philadelphia
36.	Private J. Golden	Philadelphia



Company I, 1st Pennsylvania Infantry

(CONTINUED)

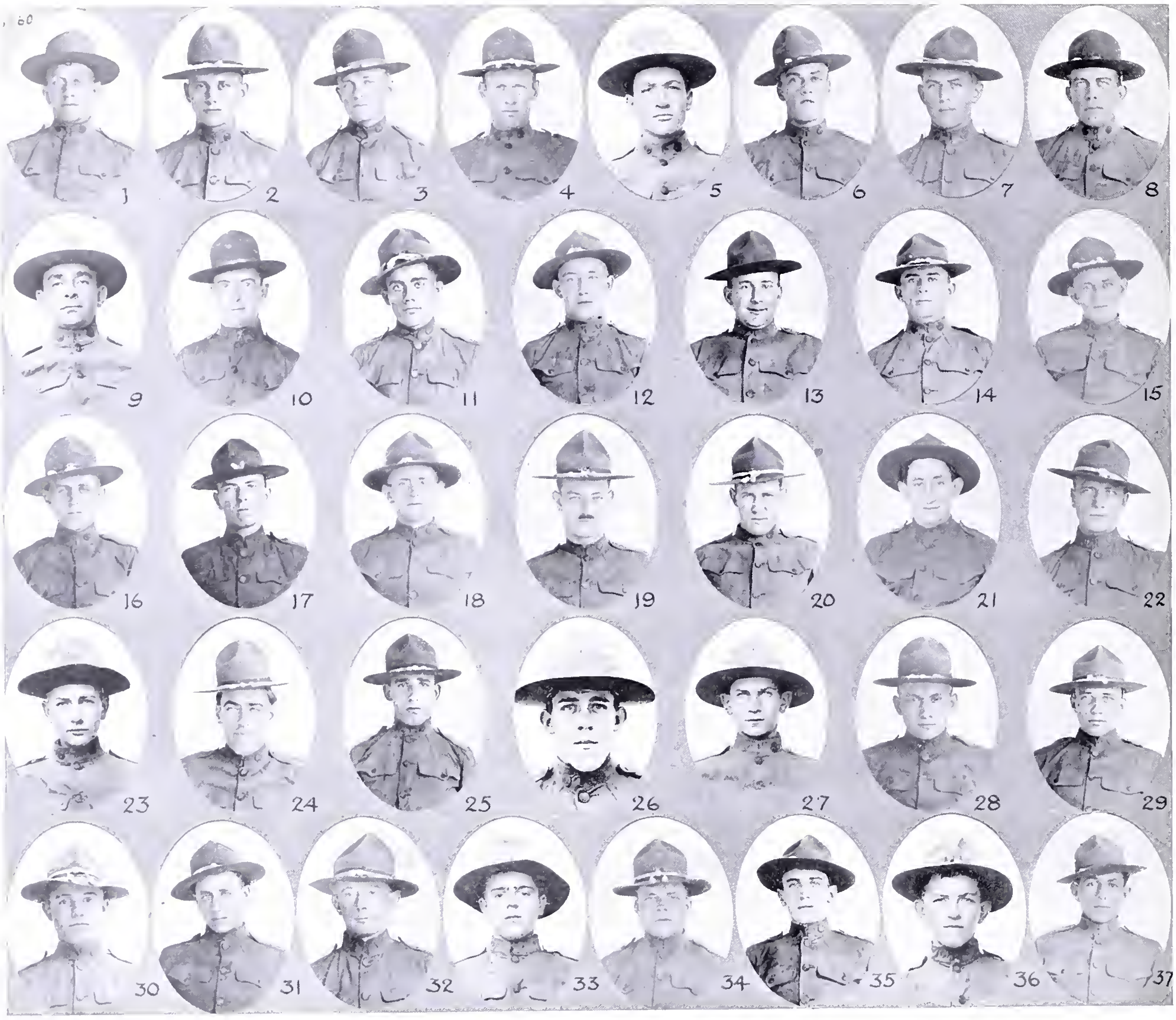
1.	Private John C. Firth	Philadelphia
2.	Private James Flanagan	Philadelphia
3.	Private Francis X. Foy	Philadelphia
4.	Private Harry E. Frederick	Philadelphia
5.	Private David Gass	Philadelphia
6.	Private Amos K. Geikler	Philadelphia
7.	Private Peter J. Gillen	Philadelphia
8.	Private George B. Given	Philadelphia
9.	Private John C. Griffin	Philadelphia
10.	Private James J. Haley	Philadelphia
11.	Private Chrissie Heilman.	Newtown Square, Pa.
12.	Private Daniel C. Herr.	Philadelphia
13.	Private Frank L. Hesson	Philadelphia
14.	Private Alexander E. Hodgeman	Philadelphia
15.	Private Gail L. Hook	Birdsboro, Pa.
16.	Private Charles A. Hopkins.	Philadelphia
17.	Private Andrew W. Hughes	Philadelphia
18.	Private Harry H. Huntzinger	Philadelphia
19.	Private John B. Jordan	Philadelphia
20.	Private William Johns	Philadelphia
21.	Private Joseph C. Ireland	Philadelphia
22.	Private Daniel J. Kane	Philadelphia
23.	Private Richard J. Kane	Philadelphia
24.	Private William A. Keller	Philadelphia
25.	Private Bavil S. Kenerson	Philadelphia
26.	Private Timothy Kerns	Philadelphia
27.	Private Frank W. Kline	Philadelphia
28.	Private Howard L. Kennedy	Philadelphia
29	Private Joseph Labriola	Philadelphia
30.	Private William F. Lacy	Philadelphia
31.	Private Edward J. Lee	Philadelphia
32.	Private Joseph C. Le Fevre	Hanover, Pa.
33.	Private Harry Lunemann	Philadelphia
34.	Private Elmer McCaulley	Philadelphia
35.	Private John McCrossen	Philadelphia
36.	Private Ignatius McManus	Philadelphia



Company I, 1st Pennsylvania Infantry

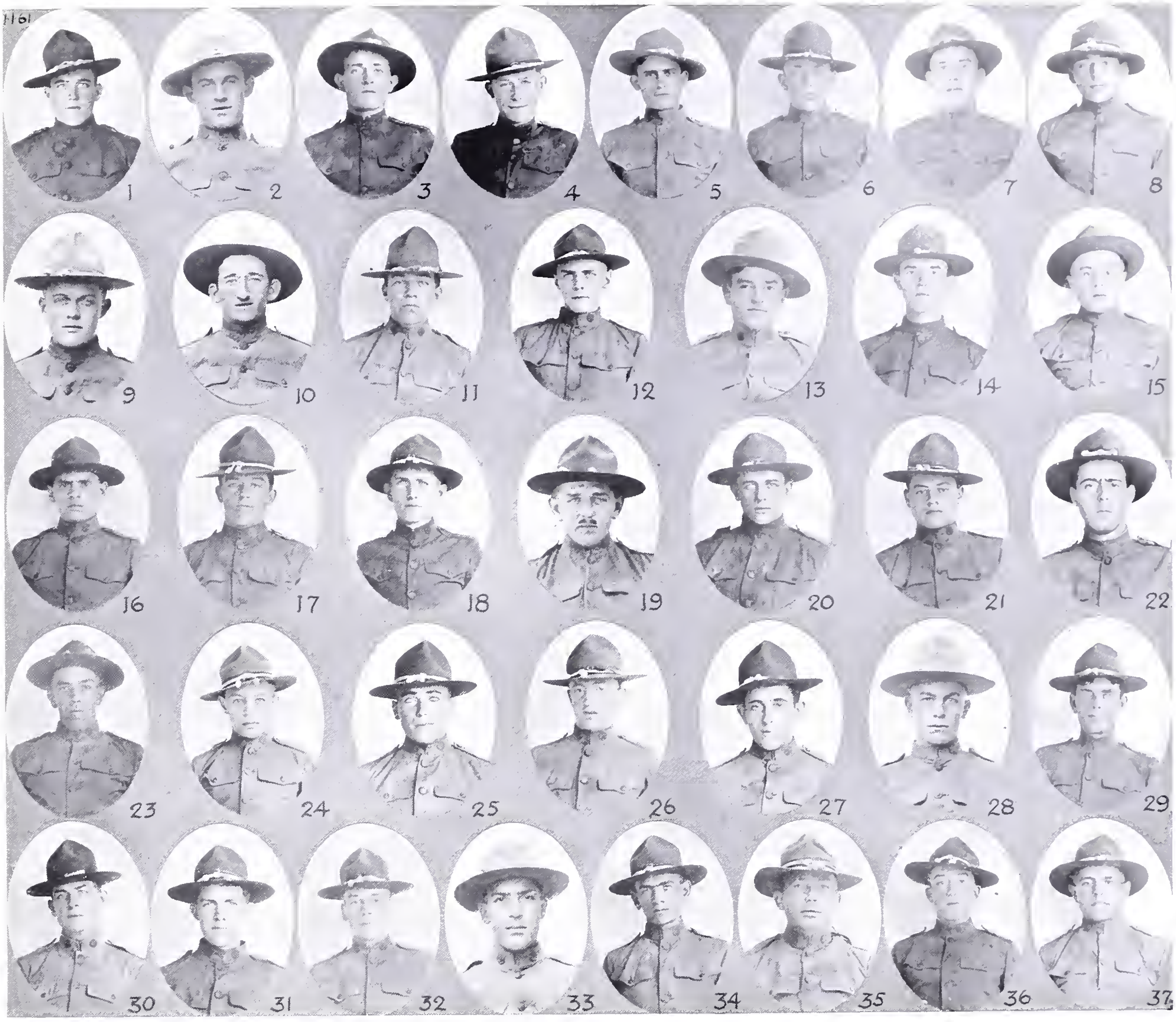
(CONTINUED)

1.	Private J. McCoach	
2.	Private Paul J. Mahunik	Philadelphia
3.	Private John V. Manning	Philadelphia
4.	Private Albert Montgomery	Philadelphia
5.	Private Harry Montgomery	Philadelphia
6.	Private Horace Moore	Philadelphia
7.	Private Anthony Murray	Philadelphia
8.	Private R. Miller	Philadelphia
9.	Private Vincent P. Nagle	Philadelphia
10.	Private Joseph Nay	Philadelphia
11.	Private William H. Neil	Philadelphia
12.	Private Daniel J. O'Donnell	Philadelphia
13.	Private John F. Owens	Philadelphia
14.	Private Joseph Padulese	Philadelphia
15.	Private Anthony C. Pelo	Philadelphia
16.	Private Ulysses G. Read	Philadelphia
17.	Private Richard Redmond	Philadelphia
18.	Private John J. Rocke	Philadelphia
19.	Private Joseph E. Schlechter	Philadelphia
20.	Private Joseph A. Schreiber	Philadelphia
21.	Private Raymond Schwartz	Philadelphia
22.	Private Fred Scullion	Philadelphia
23.	Private William J. Seerey	Philadelphia
24.	Private William R. Shinn	Philadelphia
25.	Private Arthur R. Sloan	Philadelphia
26.	Private William Smith	Philadelphia
27.	Private Edward Snitzer	Philadelphia
28.	Private John Sobel	Philadelphia
29.	Private Sherman C. Starrett	Philadelphia
30.	Private Joseph W. Strain	Philadelphia
31.	Private William B. Taylor	Philadelphia
32.	Private Horace Teenie	Burham, Pa.
33.	Private Robert Trevethan	Philadelphia
34.	Private Maurice Waldman	Philadelphia
35.	Private Thomas J. Whelan	Philadelphia
36.	Private John J. Wolfe	Philadelphia



Company K, 1st Pennsylvania Infantry

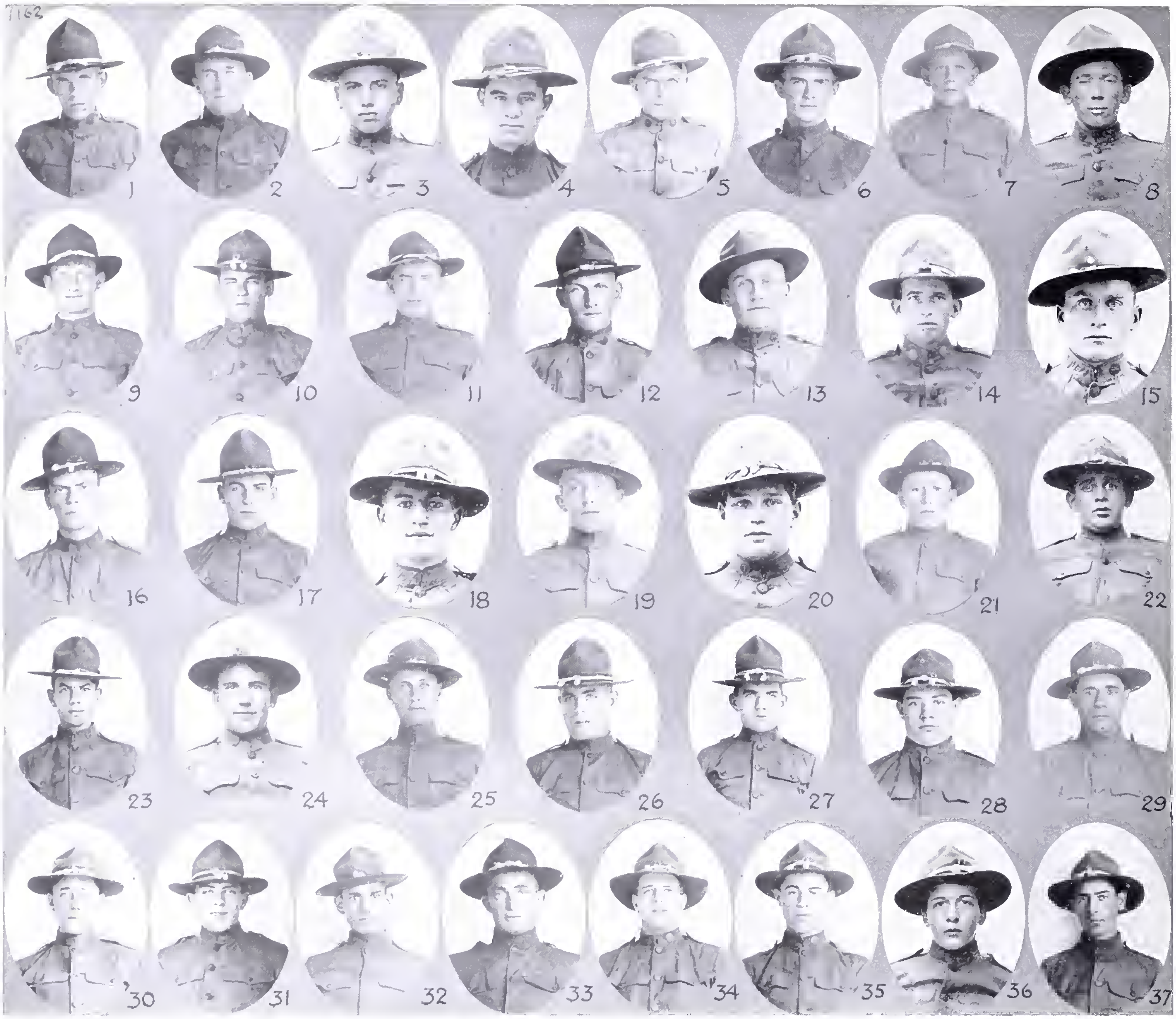
1.	Supply Sergeant Marcus S. DeWolf	Philadelphia
2.	Sergeant Charles E. Hein	Philadelphia
3.	Sergeant William H. Deal	Philadelphia
4.	Sergeant Alonzo F. Chancellor	Philadelphia
5.	Sergeant Thomas W. Kelly, Jr.	Philadelphia
6.	Sergeant Emil F. Lange	Philadelphia
7.	Sergeant Francis H. Meara	Philadelphia
8.	Sergeant Harold Gould	Maple Shade, N. J.
9.	Corporal Charles R. Kimball	Philadelphia
10.	Mess Sergeant John F. Burke	Philadelphia
11.	Cook David Adelman	Philadelphia
12.	Cook Thomas E. Jacobs	Philadelphia
13.	Musician Sydney B. Street	Secane, Del. Co., Pa.
14.	Private Henry D. Cox	Philadelphia
15.	Corporal Austin Hudson	Philadelphia
16.	Mechanic Albert F. Noble	Springfield, Mass.
17.	Corporal Charles H. Shriver	Philadelphia
18.	Corporal George F. Sloan	Philadelphia
19.	Private William T. Allen	South Westport, Mass.
20.	Private John H. Alcorn	Harrisburg, Pa.
21.	Private Harry Atlas	Philadelphia
22.	Corporal John T. Baird	Philadelphia
23.	Private Lawrence C. Bell	Riverton, N. J.
24.	Private Samuel A. Bangs	Philadelphia
25.	First-class Private Daniel B. Basford	Philadelphia
26.	Private Harry J. Becker	Philadelphia
27.	Private Harry C. Berman	Philadelphia
28.	Private Stephen Bednarz	Philadelphia
29.	Musician Joshua M. Bennet	Philadelphia
30.	First-class Private Albert H. Boyer	Philadelphia
31.	Private Joseph F. Brilla	Philadelphia
32.	Private John A. Brown	Philadelphia
33.	Private Ercil Bollendorf	Philadelphia
34.	Private William F. Brown	Philadelphia
35.	Private Stewart C. Brown	Philadelphia
36.	Private Frank L. Brysin	Philadelphia
37.	Private Frank Bueno	San Antonio, Texas



Company K, 1st Pennsylvania Infantry

(CONTINUED)

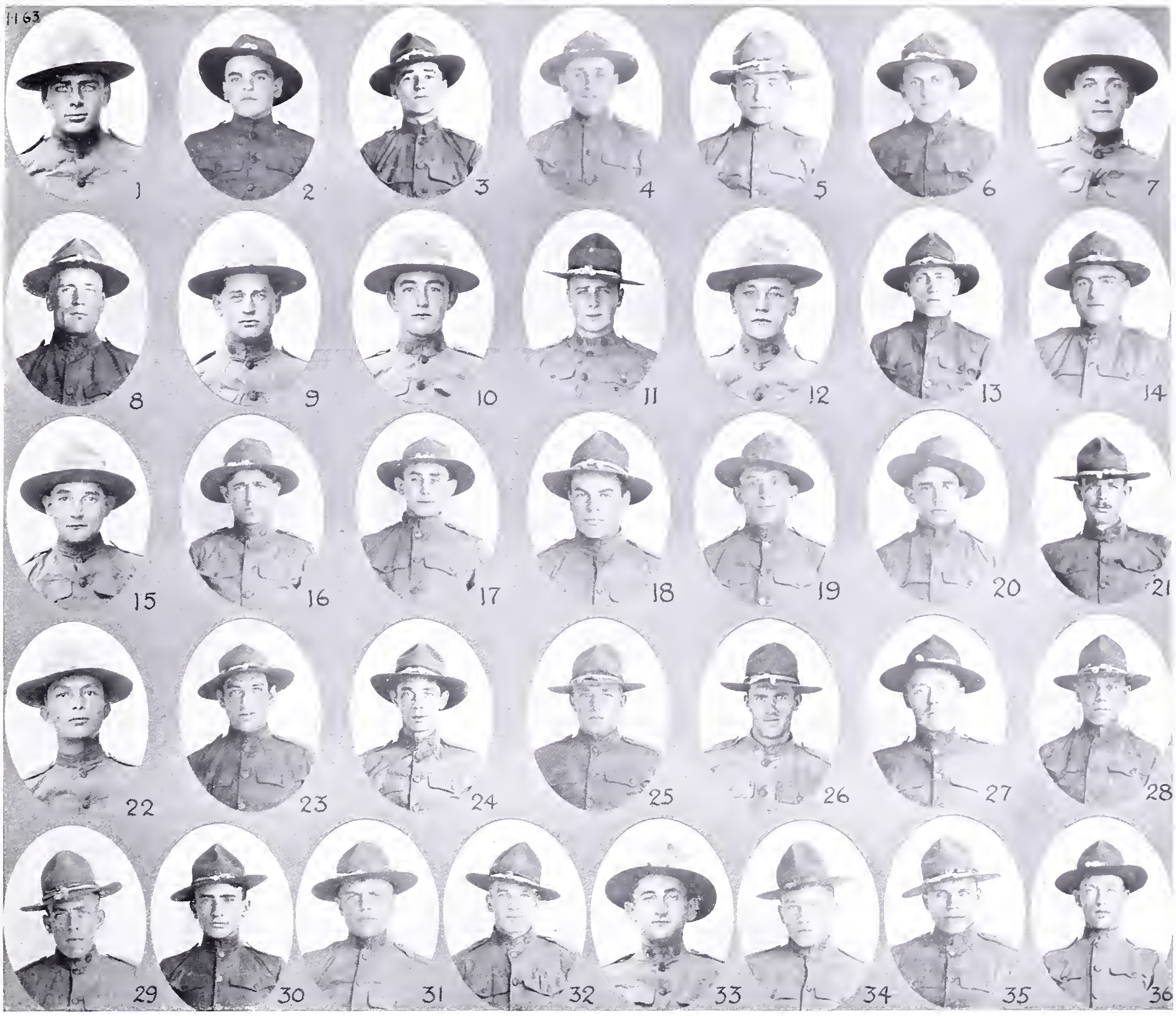
1.	Private Thomas J. Burke	Philadelphia
2.	Private Joseph C. Burns	Philadelphia
3.	Private Patrick Burns, Jr.	Philadelphia
4.	Private William D. Callahan	Philadelphia
5.	Private Anthony Caveritta	Philadelphia
6.	First-class Private Edward L. Chapman	Philadelphia
7.	Private Francis X. Conley	Philadelphia
8.	Private George Cosch	Philadelphia
9.	First-class Private George H. Cox	Philadelphia
10.	Private Gerald E. Connelly	Philadelphia
11.	Private Theodric G. Dillon	Philadelphia
12.	Private Samuel C. Dinsmore	Philadelphia
13.	Private Hugh J. Dougherty	Philadelphia
14.	First-class Private Walter Duncan	Philadelphia
15.	Private Joe Doz	Philadelphia
16.	Private George Di Persia	Philadelphia
17.	Private Henry F. Eaton	Philadelphia
18.	Private George G. Eckelman	Philadelphia
19.	Corporal Theodore C. Englebert	St. Davids, Pa.
20.	First-class Private William R. Epler, Jr.	Philadelphia
21.	First-class Private Jacques A. Fiechter	Philadelphia
22.	Private William S. Gaul	Philadelphia
23.	Private William E. J. Glackens	Philadelphia
24.	First-class Private Raymond Galbraith	Philadelphia
25.	Corporal John J. Gallagher	Philadelphia
26.	Private Thomas J. Gilmore	Philadelphia
27.	Private Benjamin Goldberg	Philadelphia
28.	Private Joseph F. Gothie	Philadelphia
29.	Mechanic Richard Graven	Philadelphia
30.	Corporal William E. J. Grocke	Philadelphia
31.	Private George Hall	Philadelphia
32.	Private George Hebden	Philadelphia
33.	Corporal Ralph C. Hevener	Philadelphia
34.	Private Louis S. Horowitz	Philadelphia
35.	Private Charles L. Howard	Philadelphia
36.	Private John J. Hughs	Philadelphia
37.	Private Michael Humeny	Philadelphia



Company K, 1st Pennsylvania Infantry

(CONTINUED)

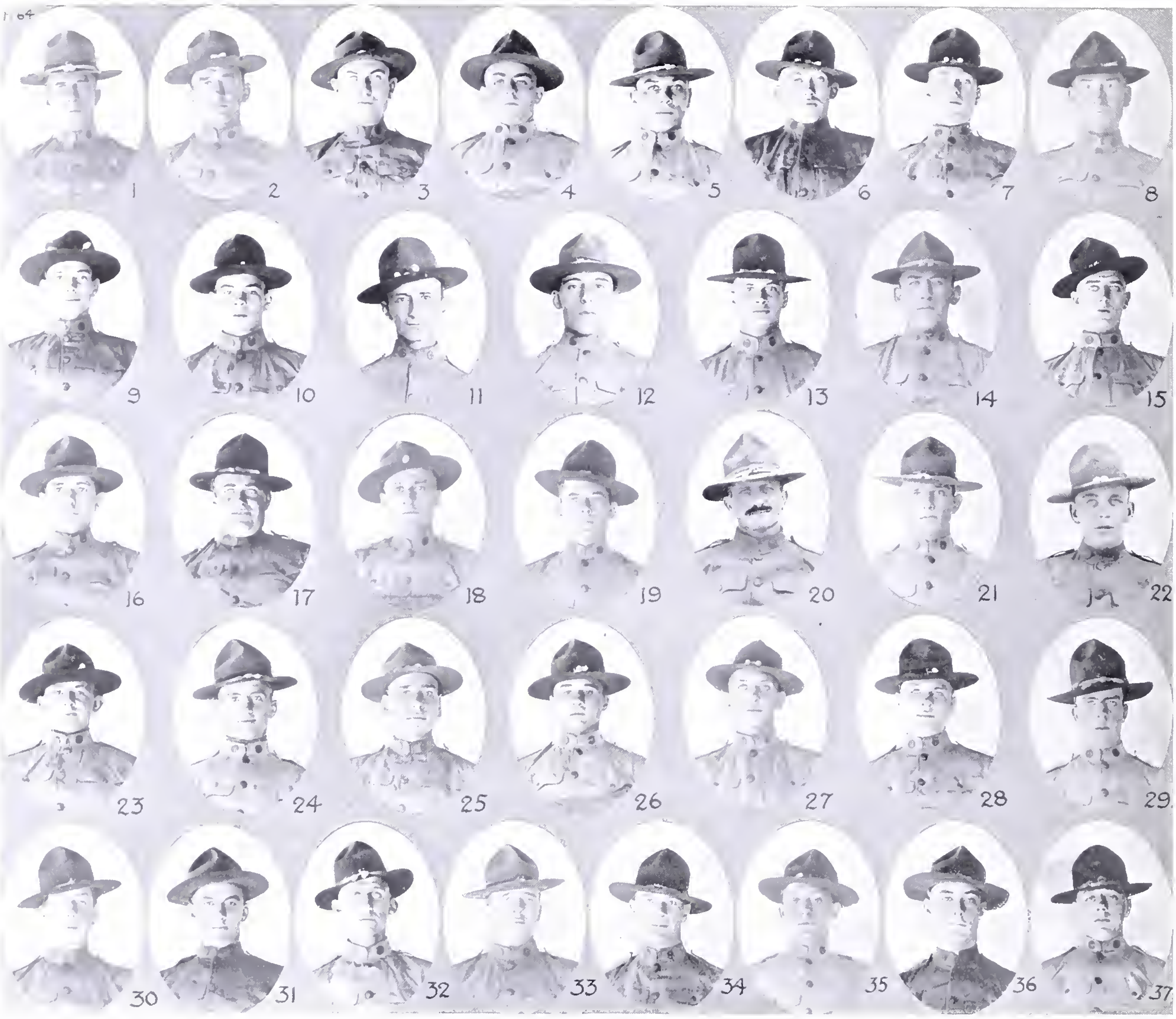
1.	Private George R. Inke	Philadelphia
2.	Private Thomas Innes	Philadelphia
3.	First-class Private Morris H. Jacobson	Philadelphia
4.	First-class Private Simon Katz	Philadelphia
5.	First-class Private William L. Kelly	Clifton Heights, Pa.
6.	Private John H. Kirk	Philadelphia
7.	Private Peter Kolf	Philadelphia
8.	Private George W. Leach	Fox Chase, Pa.
9.	Private William S. Lindsay	Philadelphia
10.	Private Joseph Lisiewiz	Philadelphia
11.	Private William J. Leonard	Philadelphia
12.	Private Joseph J. Lory	Philadelphia
13.	Private Leroy T. Lynch	Philadelphia
14.	Private Ernest A. Lute	Selma, Ala.
15.	Private Leroy T. Lynch	Philadelphia
16.	Private James W. Lyon	Philadelphia
17.	Private Thomas J. McAdorey	Philadelphia
18.	Private Frank J. McDevitt	Philadelphia
19.	Private Joseph P. McGlinchey	Philadelphia
20.	Private John McGovern	Philadelphia
21.	Private John J. McKnight	Philadelphia
22	Private Joseph D. Mahon	Philadelphia
23.	First-class Private N. Frank Mansfield, Jr.	Philadelphia
24.	Private John A. Maywhort	Philadelphia
25.	First-class Private Domenick Mazzolia	Philadelphia
26.	First-class Private Martin Merrick	Philadelphia
27.	Private John M. Murra	Philadelphia
28.	Private Hugh F. Murray	Philadelphia
29.	Private Charles G. Nazarene	Philadelphia
30.	Private James A. Norris, Jr	Philadelphia
31.	Private John J. O'Donnell	Philadelphia
32.	Private Philip Paporne	Parkesburg, Pa.
33.	Corporal Charles A. Parsons	Haverford, Pa.
34.	Private Meriditħ H. Parsons	Haverford, Pa.
35	First-class Private Philip Patterson	Philadelphia
36.	Private Robert Pennegar	Philadelphia
37.	Private Joseph J. Perry	Philadelphia



Company K, 1st Pennsylvania Infantry

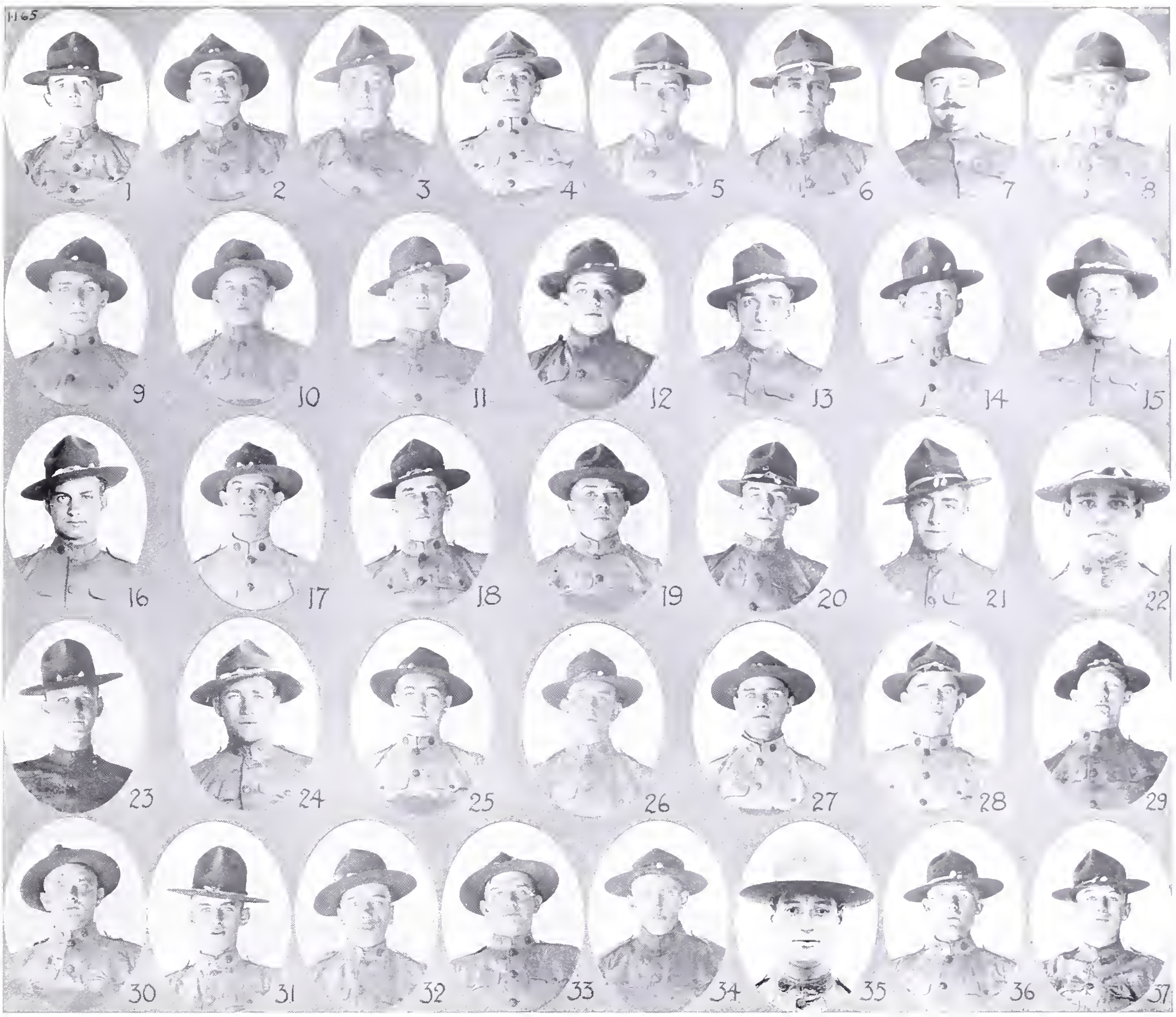
(CONTINUED)

1.	Corporal Romeyn Pierson	Philadelphia
2.	Private John Pulaski	Philadelphia
3.	Private Charles P. Pursley	Philadelphia
4.	Private Harry L. Reichardt	Philadelphia
5.	Private Daniel Reppert	Boyertown, Pa.
6.	Corporal Edward J. Riehl	Philadelphia
7.	Private Frederick F. Reimer	Philadelphia
8.	First-class Private Joseph J. Roche	Philadelphia
9.	Corporal Lawrence E. Roe	Philadelphia
10.	Private Bernard F. Rogers	Philadelphia
11.	First-class Private Francis X. Ryan	Philadelphia
12.	Private Stanley Salesky	Philadelphia
13.	Private Harry P. L. Sandy	Philadelphia
14.	Private Herman F. Schonstein	Philadelphia
15.	Private Christopher Shaw	Philadelphia
16.	Private Jacob Soafer	Philadelphia
17.	Private John Siarozynsky	Philadelphia
18.	Private August F. Steiner	Philadelphia
19.	Private David Stern	Philadelphia
20.	Corporal George K. Streaker	Philadelphia
21.	Cook Henry J. Sullivan	Philadelphia
22.	Private John Supko	Philadelphia
23.	Private Louis Surkin	Philadelphia
24.	Private John J. Tobin	Philadelphia
25.	First-class Private William A. Trout	Philadelphia
26.	Private David Troupe	West Manayunk, Pa.
27.	First-class Private Jacob A. Tyer	Philadelphia
28.	Private Thomas Verrichi	Philadelphia
29.	First-class Private Thomas H. Wall	Philadelphia
30.	Private Israel Wagner	Philadelphia
31.	Corporal Albert A. White	Conshohocken, Pa.
32.	Private John White	Philadelphia
33.	Private Richard York	Camden, N. J.
34.	First-class Private William H. Young	Philadelphia
35.	Private Antonia Zerkas	Philadelphia
36.	Corporal William S. Gannon	Philadelphia



Company L, 1st Pennsylvania Infantry

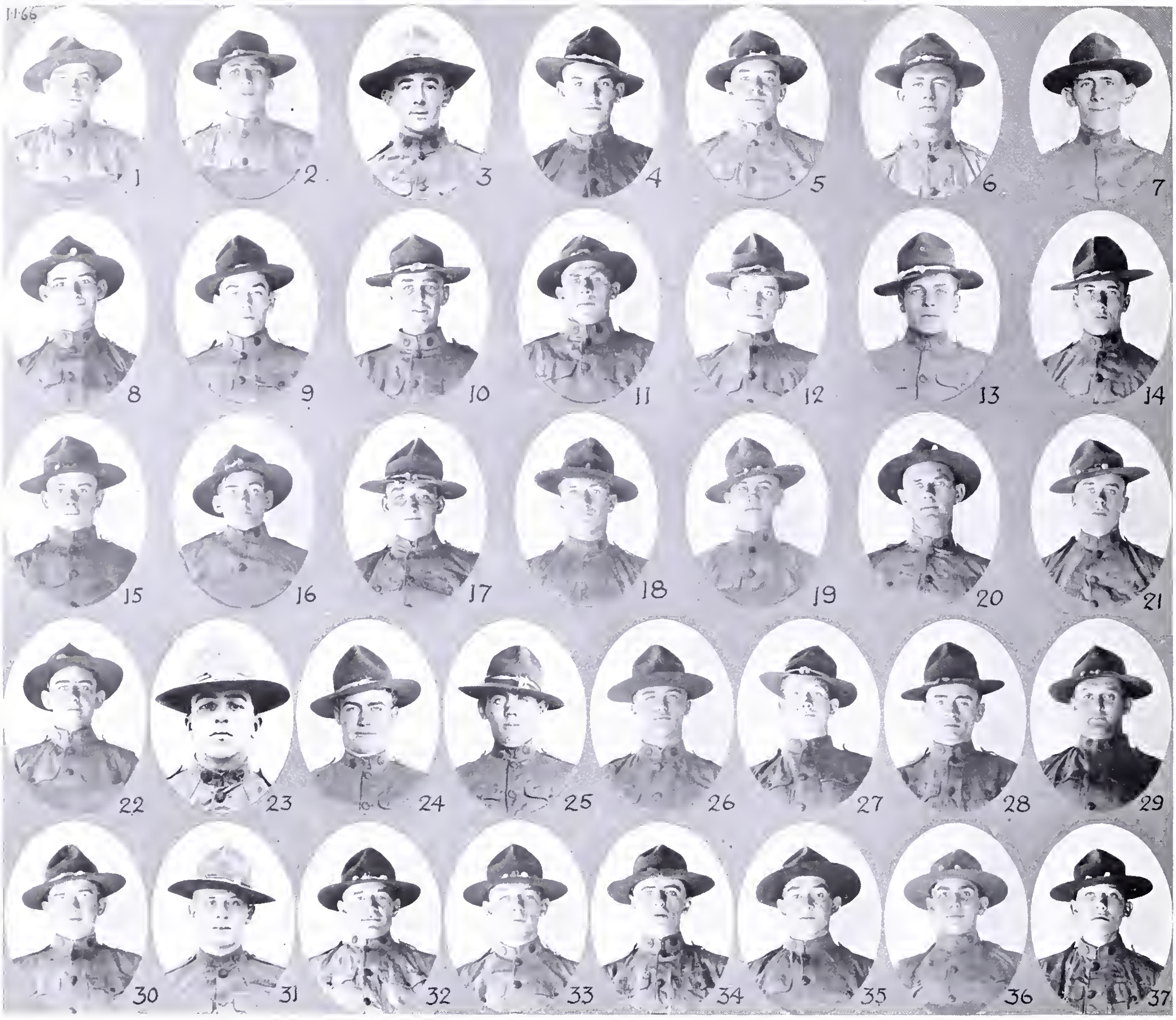
1.	First Sergeant Thomas W. Bower	Philadelphia
2.	Mess Sergeant Louis J. Herre	Philadelphia
3.	Supply Sergeant Thomas B. McCormick	Philadelphia
4.	Sergeant Samuel B. White	Atlantic City, N. J.
5.	Sergeant Abraham Mildenberg	Philadelphia
6.	Sergeant David Robb	Philadelphia
7.	Sergeant Mitchell A. Barrett	Philadelphia
8.	Sergeant James Robinson	Philadelphia
9.	Sergeant John F. Schultz	Media, Pa.
10.	Sergeant William Bateman	Wayne, Pa.
11.	Corporal Frank J. Deal	Philadelphia
12.	Corporal George H. West	Philadelphia
13.	Corporal James Bewley	Oak View, Pa.
14.	Corporal William P. Ahern	Philadelphia
15.	Corporal Richard E. Mount	Philadelphia
16.	Corporal Marius Piberes	Philadelphia
17.	Corporal Donald J. Donovan	Philadelphia
18.	Mechanic William J. Hort	Philadelphia
19.	Mechanic Raymond J. Corrigan	Philadelphia
20.	Cook Harry L. Maiser	Philadelphia
21.	Bugler David C. Helms	Philadelphia
22.	Bugler Howard F. Crossgrove	Philadelphia
23.	First-class Private William S. Blair, Jr	Philadelphia
24.	First-class Private Gustave B. Deschin	Philadelphia
25.	First-class Private Rudolph Gefvert	Philadelphia
26.	First-class Private Walter H. Keirsey	Philadelphia
27.	First-class Private Joseph Neiss	Philadelphia
28.	First-class Private Thomas M. J. Nixon	Philadelphia
29.	First-class Private Raymond J. O'Connell	Philadelphia
30.	First-class Private Frank J. Reilly	Philadelphia
31.	First-class Private Richard O. Schabner	Philadelphia
32.	First-class Private Harry Shimp	Philadelphia
33.	First-class Private Burrill W. Thatcher	Cleveland, Ohio
34.	First-class Private Edward F. Yearsley	Philadelphia
35.	Private Frank C. Andrews	Philadelphia
36.	Private George R. Apple	Philadelphia
37.	Private Clifford Armstrong	Philadelphia



Company L, 1st Pennsylvania Infantry

(CONTINUED)

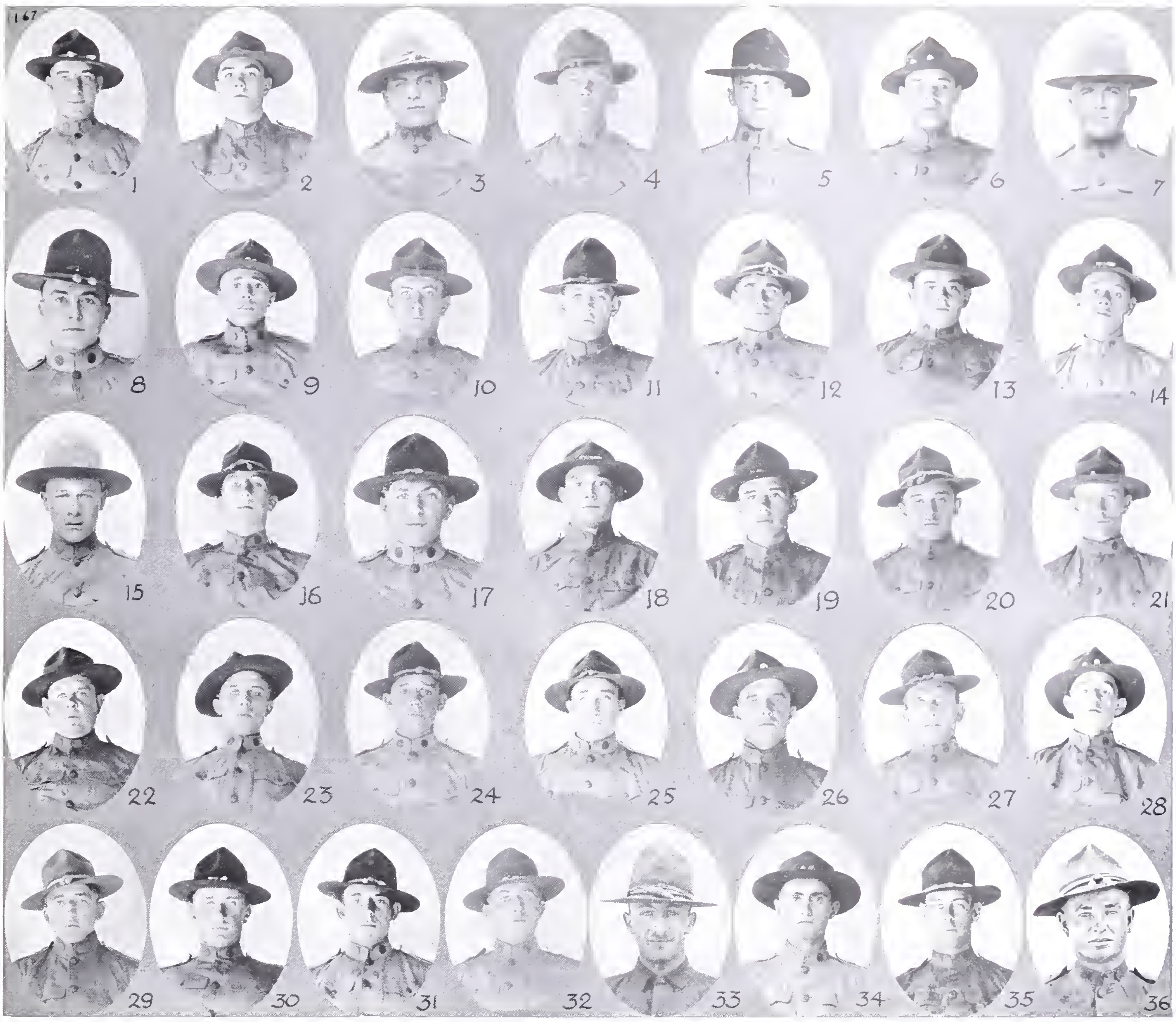
1.	Private SAMUEL L. BALLENTINE	Philadelphia
2.	Private JOHN I. BALMER	Philadelphia
3.	Private JOHN BARR	Philadelphia
4.	Private WALTER E. BAUMANN	Philadelphia
5.	Private EARLE C. BEALE	Philadelphia
6.	Private JAMES BLAKE	Savannah, Ga.
7.	Private F. G. BLAIR	Philadelphia
8.	Private HARRY W. BLESSING	Philadelphia
9.	Private OLIVER B. BLIZZARD	Philadelphia
10.	Private JOSEPH A. BONGORD	Philadelphia
11.	Private FRANCIS X. BOSLER	Philadelphia
12.	Private CHARLES BRENNER	Philadelphia
13.	Private PAUL C. BRICKER	Philadelphia
14.	Private JOHN J. BROWN	Philadelphia
15.	Private OSCAR W. BURNS	Philadelphia
16.	Private C. A. BUNTING	Philadelphia
17.	Private FRANK G. CALABRESE	Philadelphia
18.	Private JAMES J. CAMPBELL	Philadelphia
19.	Private JOHN J. CHRISWELL	Philadelphia
20.	Private THOMAS J. CLARK	Philadelphia
21.	Private STANTON H. CLOUD	Collingdale, Pa.
22.	Private FRANCIS P. CONNELLY	Philadelphia
23.	Private THOMAS B. CURRAN	Philadelphia
24.	Private WILLIAM J. CURRAN	Philadelphia
25.	Private JOHN DEVLIN, JR.	Philadelphia
26	Private PAUL V. J. DWYER	Philadelphia
27.	Private GEORGE ERSHOW	Philadelphia
28.	Private JAMES J. FINNEGAN	Philadelphia
29.	Private FREDERICK G. GARDNER	Philadelphia
30.	Private JAMES T. GARDO	Philadelphia
31.	Private EDWARD A. GLEDHILL	Philadelphia
32	Private JOHN HARRISON	Philadelphia
33.	Private ALBERT F. HEMPHILL	Philadelphia
34.	Private JOHN HENDERSON	Rockland, Mass.
35	Private JOSEPH HIBBERT	Chester, Pa.
36.	Private WILLIAM L. HOLTON	Philadelphia
37.	Private EDWARD J. HORNING	Philadelphia



Company L, 1st Pennsylvania Infantry

(CONTINUED)

1.	Private C. A. Johnson	
2.	Private Oliver K. Jamison	Philadelphia
3.	Private Nelson E. Jay	Philadelphia
4.	Private Harry B. Johnson	Asheville, N. C.
5.	Private George B. Jones	Philadelphia
6.	Private Hamilton P. Jordan	Philadelphia
7.	Private C. J. Kane	Philadelphia
8.	Private Paul Kassekert	Philadelphia
9.	Private John M. Kinzel	Philadelphia
10.	Private John C. Klees	Philadelphia
11.	Private John Krumboldtz	Philadelphia
12.	Private Michael V. Lacey	Philadelphia
13.	Private James J. Laksh	Philadelphia
14.	Private Robert Larr	Philadelphia
15.	Private Paul A Lennon	Philadelphia
16.	Private Thomas M. Lonergan	Philadelphia
17.	Private Frank J. Loos	Philadelphia
18.	Private John W. Lonley	Philadelphia
19.	Private Russell F. Lucke	Philadelphia
20.	Private George H. Majilton	Yeadon, Pa.
21.	Private Albert K. Mars	Philadelphia
22.	Private Howard L. Matthews	Sharon Hill, Pa.
23.	Private John H. Meikle	Philadelphia
24.	Private Neil P. Matthews	Philadelphia
25.	Private Robert J. Milligan	Philadelphia
26.	Private Charles A. Moffet	Philadelphia
27.	Private Thomas J. Moore	Philadelphia
28.	Private Charles L. Morris	Philadelphia
29.	Private Herbert H. Morse	Philadelphia
30.	Private John Murphy	Philadelphia
31.	Private Lawrence E. Murphy	Philadelphia
32.	Private Joseph P. McAnally	Philadelphia
33.	Private James J. McCaffrey	Philadelphia
34.	Private William H. McGarry	Philadelphia
35.	Private John McDermott	Philadelphia
36.	Private Joseph M. McGonigal	Philadelphia
37.	Private Hugh B. McKee	Philadelphia



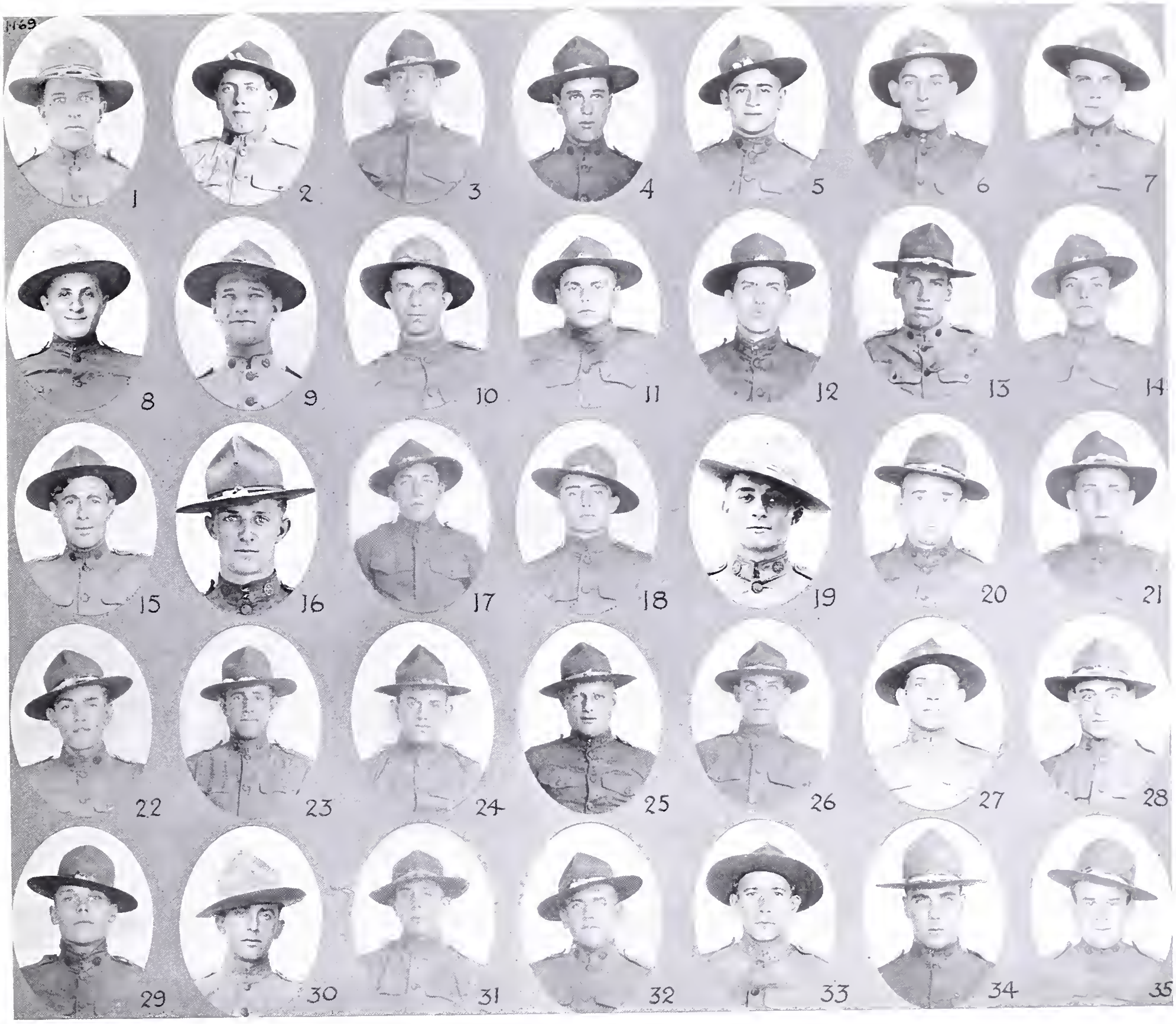
Company L, 1st Pennsylvania Infantry

(CONTINUED)

1.	Private Joseph A. McKeown	Philadelphia
2.	Private Francis McLaughlin	Philadelphia
3.	Private Louis Miller	
4.	Private Stanley Z. Norwood	Philadelphia
5.	Private H. Oschmann	Philadelphia
6.	Private Shirley O'Brien	Eddystone, Pa.
7.	Private Francis J. O'Leary	Johnstown, Pa.
8.	Private Robert E. Patchel	Philadelphia
9.	Private John R. Paynter	Philadelphia
10.	Private William R. Phreaner	Philadelphia
11.	Private Louis N. Porter	Ashbourne, Pa.
12.	Private William E. Reed	Darby, Pa.
13.	Private Stanley J. Regula	Philadelphia
14.	Private William H. Ross	Philadelphia
15.	Private Frank Rush	Chester, Pa.
16.	Private Frank Schaefer	Philadelphia
17.	Private Al. J. Schmidmeister	Philadelphia
18.	Private John D. Schofield	Philadelphia
19.	Private Frank C. Scholes	Philadelphia
20.	Private Alfred Sessa	Philadelphia
21.	Private George P. Shields	Philadelphia
22.	Private Harry Silverthorn	Philadelphia
23.	Private William J. Slemmer	Philadelphia
24.	Private Francis P. Smith	Philadelphia
25.	Private Harry J. Snear	Philadelphia
26.	Private William H. Turvey	Philadelphia
27.	Private William C. Veigtsberger	Philadelphia
28.	Private Henry F. Vollweiler	Philadelphia
29.	Private Fred G. Wadle	Philadelphia
30.	Private Rudolph Walter	Philadelphia
31.	Private William L. West	Philadelphia
32.	Private Howard P. Wheeler	Philadelphia
33.	Private Edward T. White	Darby, Pa.
34.	Private Ira E. White	Collingdale, Pa.
35.	Private Alfred S. Worthline, Jr.	Philadelphia
36.	Private Howard B. Wright	Philadelphia

Company M, 1st Pennsylvania Infantry

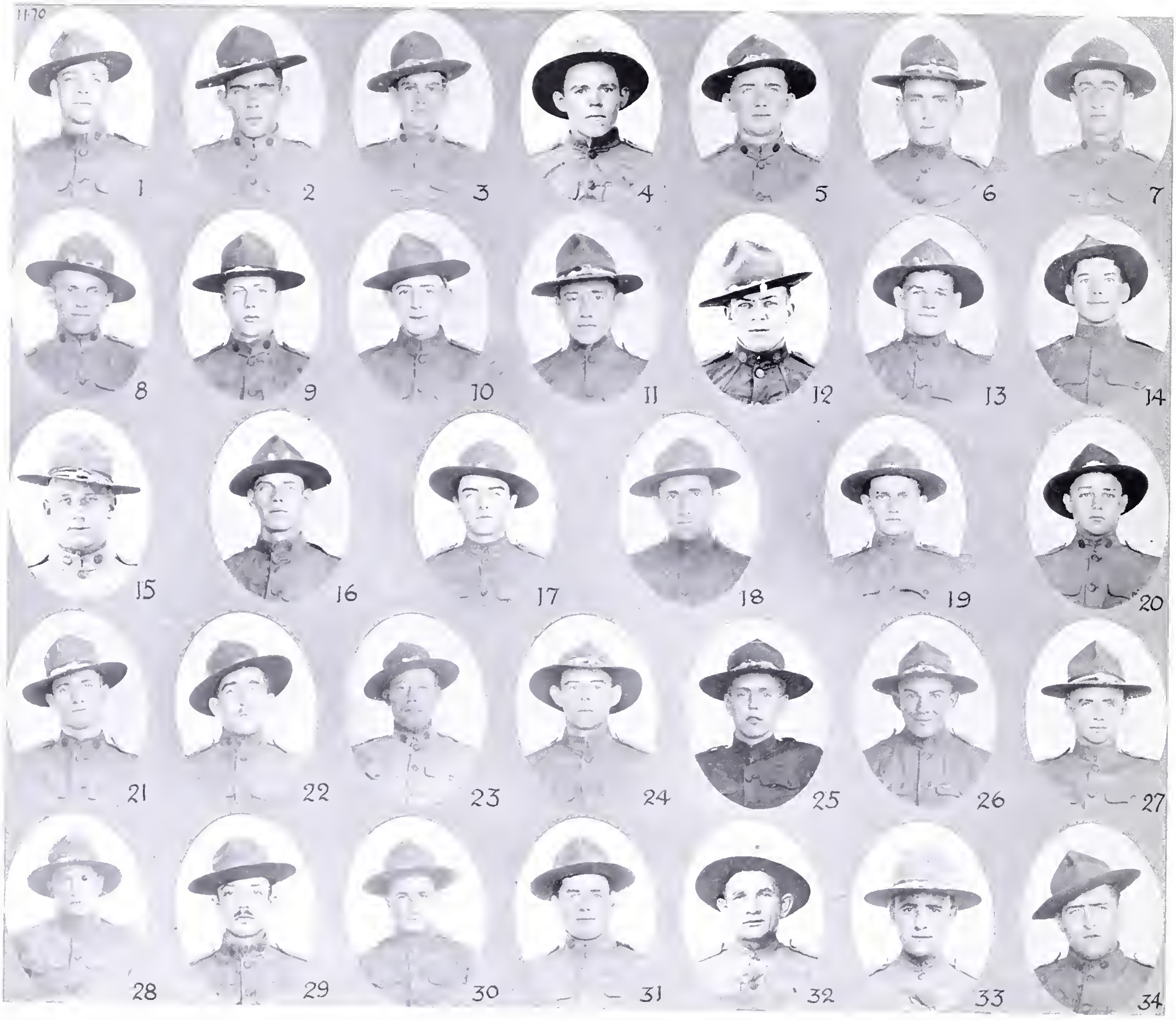
1.	First Sergeant Peter J. Bormacher	Philadelphia
2.	Sergeant Albert W. Buckner	Philadelphia
3.	Sergeant Daniel N. Conn	Oak View, Pa.
4.	Sergeant Harry T. Cross	Philadelphia
5.	First Sergeant Edward B. Goward	Philadelphia
6.	Sergeant William N. Thompson	Philadelphia
7.	Sergeant Samuel Robinson	Philadelphia
8.	Sergeant Charles C. Brown	Philadelphia
9.	Mechanic Charles S. Gehringer	Philadelphia
10.	Sergeant Anthony Novack	Philadelphia
11.	First-class Private Thomas V. Sheridan	Philadelphia
12.	Corporal Charles J. Simpson	Philadelphia
13.	Corporal Aaron Batchelor	Philadelphia
14.	Corporal Essick B. Wright	Philadelphia
15.	Corporal Victor G. Ecker	Philadelphia
16.	Corporal Clayton H. Hunsicker	Philadelphia
17.	Corporal Bruce W. Idell	Philadelphia
18.	Sergeant Charles McFadden, 3d	Philadelphia
19.	Corporal Fred J. Russell	Harrisburg, Pa.
20.	Corporal Ducoing J. Walker	Philadelphia
21.	Bugler James J. Heney	Philadelphia
22.	Cook William A. Latimer	Philadelphia
23.	Mechanic John W. Roth	Philadelphia
24.	First-class Private Robert Barr	Philadelphia
25.	First-class Private Paul R. Bisbing	Philadelphia
26.	First-class Private Clyde B. Cobaugh	Philadelphia
27.	First-class Private Edwin P. Cunningham	Philadelphia
28.	First-class Private David M. Peterson	Philadelphia
29.	First-class Private Charles F. Rinck	Philadelphia
30.	First-class Private William W. Roth	Philadelphia
31.	First-class Private John A. Weiler	Philadelphia
32.	Private Harry E. Achuff	Philadelphia
33.	Private Ralph Acosta	Philadelphia
34.	Private Ralph H. Albright	Philadelphia
35.	Private Robert Alexander	Philadelphia



Company M, 1st Pennsylvania Infantry

(CONTINUED)

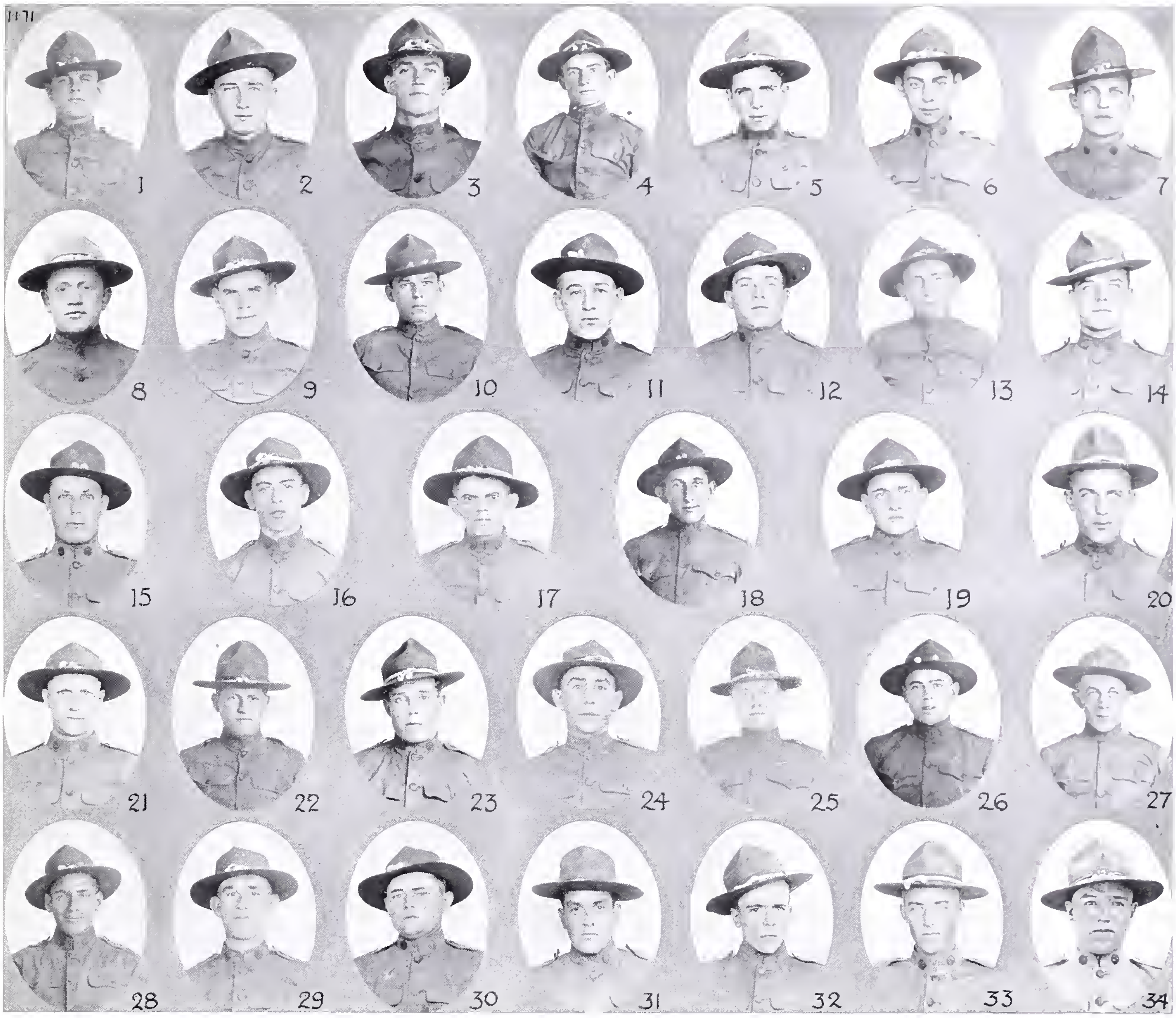
1.	Private Edward F. Bassett	Philadelphia
2.	Private Frank C. Bauder	Philadelphia
3.	First-class Private Walter H. Bleil	Philadelphia
4.	Private Nelson Boyer	Trevorton, Pa.
5.	Private Henry H. Brody	Philadelphia
6.	Private Morton McK. Bruhl	Philadelphia
7.	Private William A. Carr	Philadelphia
8.	First-class Private Jesse J. Chicone	Philadelphia
9.	Private George W. Corry	Philadelphia
10.	Private Stanley Crawford	Philadelphia
11.	Private Samuel Croucher	Philadelphia
12.	Private Warren B. Darlington	Philadelphia
13.	Private Frederick Deitz	Philadelphia
14.	Private Antonio Destefano	Philadelphia
15.	Private Samuel D. Dick	Philadelphia
16.	Private Whitford R. Dickinson	Philadelphia
17.	Private Harry F. Dreyer	Philadelphia
19.	Private Francis J. Ellis	Philadelphia
20.	Private Herman A. Farber	Philadelphia
21.	Private Thomas H. Flannery	Philadelphia
22.	Private Rowland W. Foden	Philadelphia
23.	Private Edward F. Frazer	Philadelphia
24.	Private B. Freeman	Philadelphia
25.	Private Walter H. Gabel	Philadelphia
26.	Private Francis V. Gardiner	Philadelphia
27.	Private Edward S. Gastrock	Philadelphia
28.	Private Walter Goldberg	Philadelphia
29.	Private George R. Gosner	Philadelphia
30.	Private Harry Gottschall	Philadelphia
31.	Cook Harry S. Gray	Philadelphia
32.	Private Thomas D. Griffith	Philadelphia
33.	Private Albert T. Grimes	Glenside,Pa.
34.	Private John W. Guinn	Philadelphia
35.	Private Jos. A. Geiger	Philadelphia



Company M, 1st Pennsylvania Infantry

(CONTINUED)

1.	Private Russell C. Hall	Philadelphia
2.	Private Robert A. Hanlon	Philadelphia
3.	Private Everett Henry	Paoli, Pa.
4.	Private Charles Hettel	Philadelphia
5.	Private Edwin H. Hoffman	Berwyn, Pa.
6.	Private George H. Hoffman	Philadelphia
7.	Private Stonewall J. Hower	Trevorton, Pa.
8.	Private John R. Hulme	Philadelphia
9.	Private Charles J. Husted	Philadelphia
10.	Private William Jaburg	Philadelphia
11.	Private Ralph Jenkins	Philadelphia
12.	Private Clarence J. Jones	Philadelphia
13.	Private David J. Jones	Philadelphia
14.	Private Frank Kadivnik	Philadelphia
15.	Private Einer J. Keer	Philadelphia
16.	Private Robert H. Keil	Philadelphia
17.	Private Charles L. Kelly	Philadelphia
18.	Private Kazar B. Klijian	Philadelphia
19.	Private Thomas W. Konzal	Trevorton, Pa.
20.	Private Palmer G. Kramer	Trevorton, Pa.
21.	Private Thomas H. Lewis	Philadelphia
22.	Private George W. Linker	Boston, Mass.
23.	Private Francis L. Maguire	Philadelphia
24.	Private Evans Marsh	Coatesville, Pa.
25.	Private Joseph C. McClintock	Philadelphia
26.	Private James McGee	Philadelphia
27.	Private John M. McGill	Philadelphia
28.	Private Frederick Merk	Philadelphia
29.	Private Clarence Mohn	Philadelphia
30.	Private Charles Moll	Philadelphia
31.	Private Frank J. Miller	Paterson, N. J.
32.	Private Alexander Myers	Philadelphia
33.	Private Jesse E. Newton	Philadelphia
34.	Private Bert E. O'Connell	Philadelphia



Company M, 1st Pennsylvania Infantry

(CONTINUED)

1.	Private Ralph F. Ogden	Philadelphia
2.	Private James F. O'Hearn	Strafford, Pa.
3.	Private Ingersoll Olmsted, Jr.	Philadelphia
4.	Private Delmar J. Paisley	Philadelphia
5.	Private Arthur Perry	Philadelphia
6	Private Thomas D. Phillips	Philadelphia
7.	Private William J. Quigley	Philadelphia
8.	Private Daniel J. Quinn	Philadelphia
9.	Private Harold F. Quinn	Philadelphia
10.	Private Harry Raickle	Philadelphia
11.	Private Arthur Reeder	Trevorton, Pa.
12.	Private John Rodgers	Philadelphia
13.	Private John J. Roeder	Philadelphia
14.	Private Raymond Saffren	Baltimore, Md.
15.	Private John Schrader	Trevorton, Pa.
16.	Private James Schissler	Philadelphia
17	Private Edward S. Showaker	Philadelphia
18.	Private Charles H. Simmons	Philadelphia
19.	Private Henry N. Simons	Philadelphia
20.	Private William B. Slifer	Philadelphia
21.	Private George Smith	Philadelphia
22.	Private Solomon Sobelman	Baltimore, Md.
23.	Private Herman J. Spering, Jr.	Philadelphia
24.	Private Robert F. Spicer	Philadelphia
25.	Private William E. Stauffer	Willow Grove, Pa.
26.	Private Leo H. Schissler	Philadelphia
27.	Private Carroll Taylor	Newark N. J.
28.	Private George W. Taylor	Williamstown, N. J.
29.	Private Carl Tobin	Philadelphia
30.	Private Frank Ushler	Philadelphia
31.	Cook James V. Ward	Philadelphia
32.	Private Alva D. Watson	Newark, Ohio
33.	Private Roy F. Watts	Ringgold, Ga.
34.	Private Edwin G. Anderson	Philadelphia

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